

# Ninth Annual Report

Commission  
of  
Conservation

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COMMISSION OF CONSERVATION

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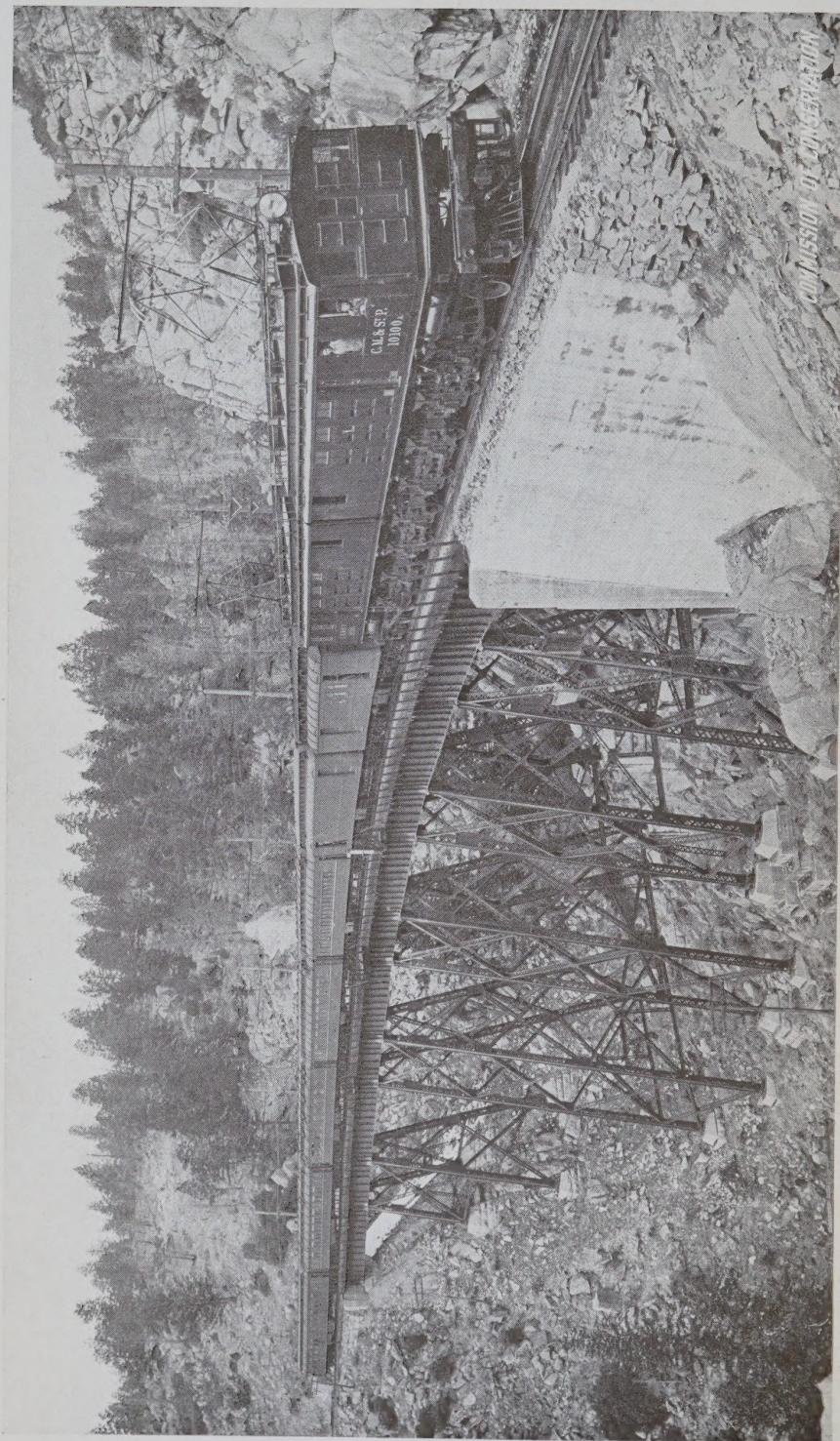
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*CONFUSION OF INVESTIGATION*

RAILWAY MOTIVE POWER OF THE FUTURE

Electric locomotive and train on the Chicago, Milwaukee and St. Paul railroad, descending a two per cent grade on the eastern slope of the Rockies.



Commission of Conservation  
Canada

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SIR CLIFFORD SIFTON, K.C.M.G., Chairman  
JAMES WHITE, Assistant to Chairman, Deputy Head

#4826-

REPORT  
OF  
THE NINTH  
ANNUAL MEETING

HELD AT OTTAWA  
NOVEMBER 27-28

1917



OTTAWA: 1918

## Commission of Conservation

Constituted under "The Conservation Act," 8-9 Edward VII, Chap. 27, 1909, and amending Acts, 9-10 Edward VII, Chap. 42, 1910, and 3-4 George V., Chap. 12, 1913.

### Chairman:

SIR CLIFFORD SIFTON, K.C.M.G.

### Members:

DR. HOWARD MURRAY, Dalhousie University, Halifax.  
DR. CECIL C. JONES, Chancellor, University of New Brunswick, Fredericton.  
MR. WILLIAM B. SNOWBALL, Chatham, N.B.  
HON. HENRI S. BÉLAND, M.D., M.P., St. Joseph-de-Beauce, Que.  
DR. FRANK D. ADAMS, Dean, Faculty of Applied Science, McGill University, Montreal.  
MGR. CHARLES P. CHOQUETTE, St. Hyacinthe, Que., Professor, Seminary of St. Hyacinthe, and Member of Faculty, Laval University.  
MR. EDWARD GOHIER, St. Laurent, Que.  
DR. JAMES W. ROBERTSON, C.M.G., Ottawa.  
HON. SENATOR WILLIAM CAMERON EDWARDS, Ottawa.  
MR. CHARLES A. MCCOOL, Pembroke, Ont.  
SIR EDMUND B. OSLER, M.P., Toronto.  
MR. JOHN F. MACKAY, Business Manager, *The Globe*, Toronto.  
DR. B. E. FERNOW, Dean, Faculty of Forestry, University of Toronto, Toronto.  
DR. GEORGE BRYCE, University of Manitoba, Winnipeg.  
DR. WILLIAM J. RUTHERFORD, Member of Faculty, University of Saskatchewan, Saskatoon.  
DR. HENRY M. TORY, President, University of Alberta, Edmonton.  
MR. JOHN PEASE BABCOCK, Victoria, B.C.  
MR. W. F. TYE, Montreal.

### Members ex-officio:

HON. THOMAS A. CRERAR, Minister of Agriculture, Ottawa.  
HON. ARTHUR MEIGHEN, Minister of the Interior, Ottawa.  
HON. MARTIN BURRELL, Minister of Mines, Ottawa.  
HON. AUBIN E. ARSENAULT, Premier, Prince Edward Island.  
HON. ORLANDO T. DANIELS, Attorney-General, Nova Scotia.  
HON. E. A. SMITH, Minister of Lands and Mines, New Brunswick.  
HON. JULES ALLARD, Minister of Lands and Forests, Quebec.  
HON. G. H. FERGUSON, Minister of Lands, Forests and Mines, Ontario.  
HON. THOMAS H. JOHNSON, Attorney-General, Manitoba.  
HON. GEORGE W. BROWN, Regina, Sask.  
HON. CHARLES STEWART, Premier, Minister of Railways and Telephones, Alberta.  
HON. T. D. PATTULLO, Minister of Lands, British Columbia.

### Assistant to Chairman, Deputy Head:

MR. JAMES WHITE,

## Committees of the Commission of Conservation, 1918

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### COMMITTEE ON FISHERIES, GAME AND FUR-BEARING ANIMALS

Dr. C. C. Jones, *Chairman*; Mr. J. P. Babcock, Dr. Howard Murray, Dr. J. W. Robertson, Hon. A. E. Arsenault, Hon. O. T. Daniels, Hon. G. H. Ferguson, Hon. Thomas H. Johnson, Hon. T. D. Pattullo, Hon. E. A. Smith.

### COMMITTEE ON FORESTS

Senator W. C. Edwards, *Chairman*; Dr. Frank D. Adams, Mr. J. P. Babcock, Dr. B. E. Farnow, Mr. W. B. Snowball, Hon. T. A. Crerar, Hon. Arthur Meighen, Hon. Martin Burrell, and the ex-officio members of the Commission who represent the various Provinces.

### COMMITTEE ON LANDS

Dr. J. W. Robertson, *Chairman*; Dr. Frank D. Adams, Rev. Dr. George Bryce, Mgr. C. P. Choquette, Mr. E. Gohier, Dr. C. C. Jones, Dr. W. J. Rutherford, Dr. H. M. Tory, Hon. T. A. Crerar, Hon. Arthur Meighen, Hon. Martin Burrell, and the ex-officio members of the Commission who represent the various Provinces.

### COMMITTEE ON MINERALS

Dr. Frank D. Adams, *Chairman*; Mr. J. P. Babcock, Mgr. C. P. Choquette, Mr. J. F. MacKay, Dr. Howard Murray, Hon. T. A. Crerar, Hon. Arthur Meighen, Hon. Martin Burrell, and the ex-officio members of the Commission who represent the various Provinces.

### COMMITTEE ON PRESS AND CO-OPERATING ORGANIZATIONS

Mr. J. F. MacKay, *Chairman*; Mr. J. P. Babcock, Rev. Dr. George Bryce, Dr. Howard Murray, Dr. H. M. Tory,

### COMMITTEE ON PUBLIC HEALTH

Sir Edmund B. Osler, *Chairman*; Hon. H. S. Béland, Mgr. Choquette, Dr. C. C. Jones, Dr. W. J. Rutherford, Hon. G. W. Brown, Hon. Martin Burrell.

### COMMITTEE ON WATERS AND WATER-POWERS

Hon. H. S. Béland, *Chairman*; Mr. C. A. McCool, *Acting Chairman*; Dr. Frank D. Adams, Dr. B. E. Farnow, Hon. Jules Allard, Hon. G. H. Ferguson, Hon. T. D. Pattullo, Hon. E. A. Smith.

To His Excellency Victor Christian William, Duke of Devonshire, Marquis of Hartington, Earl of Devonshire, Earl of Burlington, Baron Cavendish of Hardwicke, Baron Cavendish of Keighley, K.G., P.C., G.C.M.G. G.C.V.O., etc., etc., Governor General of Canada.

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to lay before Your Excellency the Ninth Annual Report of the Commission of Conservation for the year 1917.

Respectfully submitted

CLIFFORD SIFTON

*Chairman*

OTTAWA, JAN. 26, 1918

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OTTAWA, Jan. 25, 1918

SIR:

I have the honour to transmit herewith the Ninth Annual Report of the Commission of Conservation. This contains a report of the proceedings of the Ninth Annual Meeting, held in Ottawa on November 27-28, 1917, in which is included summary statements of the work done under the several committees of the Commission, during the year 1917.

Respectfully submitted

JAMES WHITE

*Assistant to Chairman*

SIR CLIFFORD SIFTON,  
Chairman, Commission of Conservation

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PROCEEDINGS  
OF THE  
NINTH ANNUAL MEETING  
OF THE  
COMMISSION OF CONSERVATION  
HELD AT  
OTTAWA, NOVEMBER 27 and 28, 1917

THE Ninth Annual Meeting of the Commission of Conservation was held at the offices of the Commission, Ottawa, on November 27 and 28, 1917. The Chairman, Sir Clifford Sifton, presided. The members present were:

Dr. Frank D. Adams, Montreal  
Mr. John Pease Babcock, Victoria  
Hon. George W. Brown, Regina  
Dr. George Bryce, Winnipeg  
Mgr. C. P. Choquette, St. Hyacinthe  
Hon. O. T. Daniels, Halifax  
Hon. Senator W. C. Edwards, Ottawa  
Dr. C. C. Jones, Fredericton  
Mr. C. A. McCool, Pembroke, Ont.  
Dr. Howard Murray, Halifax  
Dr. J. W. Robertson, Ottawa  
Dr. W. J. Rutherford, Saskatoon  
Mr. W. B. Snowball, Chatham, N.B.

As the minutes of the last Annual Meeting had been printed in the Eighth Annual Report, they were taken as read and were approved. Expressions of regret at being unable to attend the meeting were read from Sir Edmund Osler, Toronto; Sir Adam Beck, Toronto; Hon. A. E. Arsenault, Charlottetown; Dr. H. M. Tory, Edmonton; Mr. J. F. MacKay, Toronto; and Mr. Jack Miner, of Kingsville, Ont., who had been invited to address the Commission on his work in wild life preservation.

The Chairman, Sir Clifford Sifton, then reviewed the progress of conservation in 1917.

## Conservation in 1917

BY

SIR CLIFFORD SIFTON

*Chairman, Commission of Conservation*

GENTLEMEN: On the occasions of our last annual meeting and the previous one I had not the pleasure of being present with you and was obliged to deliver my annual statement by proxy. On the present occasion, not being very certain of my movements, I thought it wise to anticipate the usual date of the meeting, more especially as there are one or two questions which, in my opinion, can be more advantageously dealt with at the present time than at a later date.

It will, I am sure, be a matter of great regret to the members of the Commission to learn that one of our members, Dr. Béland, M.P., is still a prisoner in the hands of the Germans. In his own person and in family bereavements, Dr. Béland has suffered most grievously. While information is more or less unsatisfactory and incomplete, it seems quite clear that this genial and true-hearted gentleman, giving freely of his professional skill to alleviate suffering on the part of both friend and foe, has been subjected to treatment of the most trying character. We cannot hope that he will return to us without bearing permanent traces of the sufferings which he has undergone, but we can assure him and his relatives of our sympathy, and of a warm welcome when he is fortunate enough to be released.

### MILITARY SERVICE OF STAFF

Before dealing with other matters, I desire to say a word or two in regard to the military service of the staff of the Commission. The record follows:

Dr. C. A. Hodgetts, C.M.G., Red Cross Commissioner—  
Medical Adviser.

Bomb. Allan Donnell, 46th Queen's Battery—Assistant Editor.  
Lieut. E. C. Little, 3rd Canadian D. A. C.—Engineer.

Capt. G. H. Ferguson, Canadian Hydrological Corps—Water-power Engineer.

Pte. P. M. Baldwin, Canadian Army Medical Corps—Assistant Editor.

Pte. James Carroll, 199th Batt., Duchess of Connaught Irish Rangers—Messenger.

Pte. Oliver Master, 3rd Queen's Army Medical Corps—Assistant Secretary.

F. N. McKay, late 77th Batt., invalided back to Canada and discharged—Messenger.

Bomb. Allan Donnell has been invalided to Ottawa, and is now registered at the Sir Sandford Fleming Convalescent Home. At the battle of Vimy Ridge, Mr. Donnell had his foot badly injured by a gas shell. Fortunately, he was wearing his gas helmet, and was not seriously affected by the gas.

Pte. James Carroll was, on August 15th, reported missing. Recently, the Department of Militia cabled to England for information. As the reply was in the negative, Mr. Carroll has probably given his life for his country.

After rejection by the infantry and artillery on the ground of defective eyesight, Mr. Master went overseas as a private in the Queen's Ambulance Corps. Since his arrival, he has been transferred to the infantry.

Dr. Hodgetts is carrying on his work as Chief Red Cross Commissioner for Canada with conspicuous success. His work has been recognized by a companionship of the order of St. Michael and St. George.

There is at present but one unmarried man on the staff of the Commission, F. N. McKay, and he is a returned soldier.

In view of these facts, it will readily be seen that it has been difficult to carry on the work of the Commission effectively. The work that has been done, therefore, reflects the greater credit upon the energy and devotion of those members of the staff whose services we have been able to retain.

We are no longer under the necessity of preaching the doctrine of conservation in general terms. The whole world has been taught the necessity for conservation of all kinds of resources by the inexorable necessity of preserving the means of subsistence. A great portion of the national organization of most of the countries of the world is to-day engaged in systematic efforts to promote conservation of essential commodities.

#### NEED OF SCIENTIFICALLY TRAINED MEN

It cannot be said, however, that, in Canada, we have yet arrived at a proper conception of the economic utilization of our resources. We still persist in a great degree in the crude and wasteful methods naturally characteristic of a country where resources are abundant

and where many of those who are engaged in their exploitation are totally lacking in the scientific education which is necessary in order to make the best use of that which is placed in their hands. We are still largely dominated in Canada by the idea that any ordinarily capable amateur can do the work which ought to be done by a trained scientific man, and until we eradicate this fallacy thoroughly, and in its place implant the view that men who are technically trained are the only men competent to deal with technical problems, we shall not begin to attain to general success in making the best use of the materials which are at our disposal.

While it is true that we are still largely dominated by false ideas, it is also true that persistent work and agitation is bringing about substantially beneficial results. When I undertook the establishment of the Forestry Branch of the Department of the Interior seventeen years ago, the first discussion that took place disclosed the fact that there was not at that time known to be a single trained forester in Canada. We now have schools of forestry at Toronto, Quebec, and Fredericton, while the Dominion and provincial governments and the lumbering companies and other institutions connected with the industry have in their employ upwards of 150 trained foresters, and the number is steadily increasing. As 73 forestry students have enlisted, it is evident that, but for the war, we would have had upwards of 200 foresters in Canada.

In the conservation of water-powers, the different agencies at work have been, on the whole, fairly successful, although there is a continual struggle going on against the improvident alienation of power and we are constantly required to be on our guard.

With regard to forestry, the various organizations at work have been successful in bringing about perhaps the greatest degree of improvement that is observable in connection with any department or branch of natural resources. The Canadian Forestry Association and its secretary, Mr. Robson Black, are worthy of special mention in connection with this work.

In the conservation of coal, which is one of the most important subjects, we can record but little improvement, though the means of improvement and the methods by which improvements can be achieved are well known and thoroughly understood. So far, we have not been able to overcome official inertia and lack of appreciation of the necessities of the case.

#### FORESTS

Notwithstanding the handicap of war conditions, great progress has been made in the last year toward the better conservation of forest resources.

## NEW BRUNSWICK

**Progress of  
Forest Survey**

The forest survey and land classification of New Brunswick Crown lands has been continued, and a total of 1,200,000 acres has been surveyed since the project was initiated two years ago, of which 600,000 acres have been covered this year.

**Demand for  
Coniferous  
Species**

The demands upon New Brunswick forests are very heavy, especially for spruce used in the manufacture of paper as well as lumber. This demand has now raised the question as to whether the cut of coniferous species exceeds the annual growth. The present annual cut of the species in New Brunswick is about one-thirtieth of the total estimated amount of spruce and balsam in the province, leaving out of account the annual growth. The amount of the annual growth upon a given area is directly affected by the methods adopted and the restrictions imposed in carrying on logging operations. On poorly managed tracts, the production may be almost at a standstill. This fact serves to emphasize the urgent necessity for increasing production by scientific management. A large amount of material is wasted in the woods which could be utilized with proper care. There is also very urgent need for the development of hardwood-using industries to equalize the strain and promote the growth of coniferous trees.

**Reorganization  
of Staff**

The government of New Brunswick has made use, to a considerable extent, of the services of skilled foresters of the Commission, and the forest policy of the government is now, I believe, undergoing a change in the way of improvement. The government wishes to manage the Crown lands on a permanent instead of a temporary basis, and it is now considering a reorganization of its staff under a single head and the establishment of a genuine provincial forestry service with a co-ordinated staff for handling the questions of fire protection, scaling and enforcement of cutting regulations. It is sincerely to be hoped that this plan will be carried out and that the provincial forester will be enabled to organize his staff purely on the basis of technical qualification for the performance of duty. It is at least gratifying to note that there is a decided movement in this direction.

## QUEBEC

**Co-operation  
in Fire  
Protection**

In the province of Quebec, there has been a remarkable growth in the co-operative idea applied to forest fire prevention. The pioneer in this movement is the St. Maurice Forest Protective Association. The territory of the Lower Ottawa Association has been more than doubled by the

inclusion of the Upper Ottawa drainage, and the name has been changed to the Ottawa River Forest Protective Association. To these have been added the Laurentian and Southern St. Lawrence Forest Protective Associations, and we now have in the province of Quebec a total of some 70,000 square miles of forest lands under co-operative fire protection. This area comprises the great bulk of licensed Crown timber lands of the province as well as a large area of Crown-granted lands. The provincial government is a partner and contributes toward the support of the associations. The greatest portion of the support comes from the timber owners, who are assessed on an acreage basis. The formation of these associations has resulted in a great increase in efficiency in fire prevention and extinguishment.

**Reforesting  
Denuded  
Lands**      The reforestation of denuded lands continues to make progress, though on a small scale. The provincial forest nursery at Berthierville is to be materially extended. The reforestation work of the Laurentide Company is particularly notable. Planting also has been done by the Riordon Company and the Pejepscot Company.

So far, practically all of the forest planting has been done on privately-owned lands, but the provincial government has now under consideration the question of systematic reforestation of denuded Crown lands. Obviously, the question is one of the highest possible importance.

#### ONTARIO

**A New  
Era**      A new era has begun in the matter of protecting Ontario's forests from fire. Until last year, our references to the work in Ontario could never very much exceed a pious hope that some improvements might be made. Last year we recorded the fact that the matter had been taken up in earnest. I am pleased to say that our hopes have been realized, and we are fortunate in having with us to-day a representative of the Ontario government who will give us detailed information in regard to the new organization of the province of Ontario.

**Merit System  
Should be  
Adopted**      In view of his presence, I shall not go into any details, but I desire to take this opportunity of saying to him, and through him to the members of the Ontario Government and Legislature, on behalf of the Commission of Conservation and of all organizations interested in the conservation of Canadian forests, that the primary necessity of his organization is that it should be based completely and entirely upon the idea of technical competency. From the head of the service to the least important of its employees, the merit system should absolutely

govern, and no one should be allowed to be employed except upon the basis of qualification for the work. The success of the work will depend entirely upon the adoption of this principle. No effective forest service can be carried on when foresters are expected to combine the work of forest protection, political canvassing and general representation of the political interests of the government. This is an evil which has descended from government to government, from administration to administration. The Government of the province of Ontario, in making its new departure, has an opportunity of completely eradicating this old and vicious abuse.

**Public Opinion  
Supports It**

I wish to say to the representative of the Government of Ontario that, in making a fight for the establishment of this principle, he is not making a fight alone or in obscurity. The whole of the scientific and educated opinion of Canada and of America will be behind him. The great province of Ontario should have the best forest service in America, and we are all intensely interested in the establishment of the new service upon the soundest possible lines. We hope to see it develop in such a way that it will become a model for all other provinces in the Dominion.

**Pulpwood  
Values Help  
Settlement**

The greatly increased values of pulpwood have resulted in simplifying the question of fire protection in the new settlements of both Ontario and Quebec. The settler now finds that he can market his pulpwood at a profit, and that it is, therefore, distinctly worth preserving. This situation has stimulated settlement in the northern portions of both Ontario and Quebec, and there is some danger that the demand for timbered lands for settlement purposes may result in the opening up of areas where the soil is unfitted for agriculture. With respect generally to the forest service of the province of Ontario, it is to be hoped that the organization of the service will be made fully comprehensive, and that it will have power to deal with such questions as selection of timber lands where settlement is sought. The lack of a competent organization to deal with this question has already wrought serious and irreparable injury to the province.

**Should Supervise  
Cutting and  
Logging**

It should also have supervision of the cutting operations upon Crown lands, and the enforcement of scientific restrictions upon logging operations. The old method of organization has perpetuated the supervision of cutting operations by men who are not technically trained and whose business is simply to check the lumbermen's cut and secure the proper returns. In the proposed reorganization, this anomaly

should be done away with and all cutting on Crown lands ought to be done under technical supervision.

#### DOMINION LANDS

##### Settlers' Clearing Fires

The principal developments with reference to Dominion lands consist of improved fire legislation by Saskatchewan and Manitoba, where provision is made for the regulation of settlers' clearing fires under the permit system. In Alberta the situation urgently demands revision of the prairie fires ordinance. Legislation, as it now exists, does not fit the conditions in the northern portion of the province. The permit system should also be applied to Alberta, and we propose to continue urging this until success attends our efforts.

##### Merit System Not Adopted

So far as the Dominion government is concerned, there is practically no change. The merit system of appointment has not been adopted, and the enforcement of proper cutting regulations under technical supervision has not been carried out. The Forestry Branch is a well organized and progressive technical department, but it has no supervision over the cutting upon licensed lands. Repeated representations have been made, but, so far, no action has been taken.

##### Petawawa Forest Reserve

A good example of practical forestry work is to be found in connection with the Petawawa Military Reserve. This Commission initiated co-operation with the Militia Department. The work has now been taken over by the Forestry Branch of the Department of the Interior, and systematic forestry work is being carried on over a large area. Both the Militia and Interior departments are to be congratulated upon this interesting and valuable development.

#### BRITISH COLUMBIA

##### A Progressive Province

I have had occasion before to commend the province of British Columbia for its progressive action in connection with the conservation of forests. This province is maintaining its record, and, during the last year, it has shown the way to the rest of the Dominion by adopting the merit system of appointments in the field force of the Forest Branch. The establishment of a forest school in the University of British Columbia and the establishment of a timber testing plant on the Pacific coast are important subjects now under consideration.

#### THE PATRONAGE EVIL

Before going on to another branch of the subject, I desire to repeat and emphasize the necessity for eliminating political

patronage in connection with forestry work. There is absolutely no possibility of effective and satisfactory work being done until this is completely carried out. The most flagrant cases constantly come under our observation in which, instead of practically trained foresters, men are appointed who have absolutely no qualifications whatever for the duties that they are called upon to perform. As a matter of fact, once the patronage system is eliminated and every institution having to do with forestry and forest protection is placed permanently upon a merit basis, we shall see such rapid improvement that all previous progress will, by comparison, be hardly worth mentioning. This is really the whole question to be settled so far as conservation of forests is concerned. If the men who are in charge are, without exception, technically trained men, seized with the importance of their work and scientifically qualified for it, permitted to hire only those who are qualified to carry out their instructions and to treat them absolutely upon business principles, efficient work will be the rule and not the exception.

**Pledged to  
Abolish It**      The new Union Government is definitely pledged to the abolition of political patronage with reference to all branches of the public service. There is no branch of the public service that will profit more by the adoption of this principle than that of the forest service, and it will most certainly be the duty of the Commission of Conservation and all who sympathize with its efforts to endeavour to hold the government to the fulfilment of its pledge in this respect.

**Progress  
Already Made**      The principle is now definitely established in British Columbia; a beginning has been made in Ontario. A good beginning has also been made in the province of Quebec where the lumbermen's employees are generally appointed on merit and qualification. If, now, the principle be definitely established in the Dominion service, we may hope very soon that the last vestige of political management in the forest service will be eliminated in every portion of Canada.

**Railway Fire  
Situation**      The requirements of the Board of Railway Commissioners have been well observed on the whole, and the loss to our forests for which the railways can be held responsible is but a small fraction of the total fire loss. This, as compared with the situation ten years ago, is an improvement of the first magnitude. I should here explain that we secured the adoption of legislation by which the Board of Railway Commissioners was authorized to impose fire protection measures upon

the railways, and we then assisted the Board in drafting the regulations. When these were adopted, the Board appointed our chief forester as its chief inspector in the enforcement of fire protection regulations for all the privately-owned railways of Canada. The jurisdiction of the Railway Commission now extends to approximately 85 per cent of the railway mileage of Canada.

**Government  
Railway Lines**

There are still 4,087 miles of Dominion Government railways and 350 miles of provincially chartered railways in Alberta not subject to regulation and inspection by the Railway Commission, and the fire prevention service applicable to these two classes is not comparable to that applied under the Board of Railway Commissioners. The Minister of Railways has, so far, declined to take the progressive and effective step of adopting the regulations of the Board of Railway Commissioners in full and putting their enforcement in charge of our chief forester, unquestionably the best qualified man in Canada for the work. We trust this will soon be done. The situation at the present time, is, therefore, that the Parliament of Canada, in its zeal for the public good, requires all privately-owned railways, such as the Canadian Pacific railway, the Canadian Northern railway and the Grand Trunk railway, to submit to the regulations which are imposed for the public good by the Board of Railway Commissioners, but they will not allow the Intercolonial railway which they themselves own and manage, to be put under those regulations. The result is that on the Government's own railway the fire protective service is the worst that we have in Canada. Urgent necessity also exists for dealing with the northern railways in Alberta, and it is to be hoped that the government of that province will fall in line with the progressive spirit which has been adopted throughout the remaining portions of Canada.

**White Pine  
Blister**

I am again compelled to call attention to the seriousness of the white pine blister disease on this continent. The United States federal government has appropriated \$300,000. Ten states in the white pine region have appropriated \$200,000. The Dominion government has appropriated \$25,000, and Ontario and Quebec an equal amount. These sums are being expended for the purpose of eradicating the disease. In Quebec, the occurrence of the disease is not so serious as had been feared, but still it is quite sufficiently alarming. In Ontario, the infection is more general than had been anticipated. The situation in Ontario is unquestionably very serious. Where the disease is not checked, it inevitably results in the complete destruction of the white pine forests. Every government concerned

seems to be fully seized of the seriousness of the situation, but I conceive it my duty to say that nothing will fulfil the requirements of the case except such action as will result, at whatever sacrifice and cost, in the total eradication of the disease. If the efforts now being made are not sufficient, more extensive work should be undertaken. Nothing will be satisfactory except complete success.

**British Columbia Forestry Report** The report by Dr. H. N. Whitford and Mr. R. D. Craig on the forests of British Columbia is now in course of publication. It contains a large amount of exceedingly valuable data, and will furnish a foundation for a comprehensive forest policy in the Pacific province.

**Survey Amply Justified** An illustration of the importance of careful, scientific work in forestry has occurred in connection with this report. A demand has suddenly arisen for Sitka or silver spruce for aeroplane manufacture. The Imperial Munitions Board was compelled to call upon the Commission of Conservation for the information which it required. The fact of our British Columbia survey having been completed enabled us to furnish the information without delay, and the Munitions Board has now followed up the furnishing of this highly specialized information by asking for the services of Mr. Craig, one of our officers, whom it is desired to employ in promoting the production of the timber that is required. Had this Commission not undertaken the British Columbia survey, the information with regard to the location of this particular type of timber could not have been furnished by anybody, and the source of supply would, therefore, not have been known or available.

**Forest Resources of Saskatchewan** The compilation of the report upon the forest resources of Saskatchewan has been delayed by the illness of Mr. Blumer, who conducted the investigation. It is expected that it will be completed at an early date.

**Ontario Survey To Be Started** We intend also in a short time to undertake a survey of the forest resources of Ontario, similar to that made of British Columbia, and perhaps more extensive. Information with respect to the forest resources of Ontario is in a very fragmentary and unsatisfactory condition. There is a vast amount of information which can be collected and tabulated, but it is not open to the ordinary inquirer. I am informed that the Ontario government has assured our officers of its hearty co-operation, and I expect that this most important work will be got under way in a short time.

Pulpwood  
Investigation

Dr. C. D. Howe has been engaged upon an investigation of the reproduction and growth of the pulpwood species after logging in the St. Maurice valley, Quebec. Valuable co-operation has been furnished by the Laurentide Company and the Quebec Forest Service. It is only necessary to mention this work in order that its importance will be understood. Pulpwood has been shown to be one of our most valuable natural resources and the most inaccurate and unfortunate misconceptions have been prevalent, even amongst lumbermen and persons who should be better informed, in regard to the reproduction of pulpwood after cutting. Dr. Howe's investigation will not be completed for several years, but sufficient information has already been furnished to show the radical misconception of the facts prevalent among those who think and assert that the pulp forests reproduce themselves by annual growth within short periods of time. As a matter of fact, the actual growth in the forest is very, very slow. The larger coniferous trees are cut out. The hardwoods remain. The hardwoods, with their heavy crown cover, shade the young spruce and balsam trees to such an extent that their growth is almost incredibly slow. The successful cuttings which lumbermen tell of over the same territory, when analyzed, tell a story that is the reverse of satisfactory. It shows that instead of the forest being reproduced, the successful cuttings have been eked out by cutting smaller trees and by increasing the cut of balsam instead of spruce. Details of the results of the investigation, up to the present time, will be furnished you by Dr. Howe himself, and I need not go further into them on this occasion. What I have said, however, indicates the dangerous fallacy which is now prevalent in regard to this most important natural resource.

## LANDS

Illustration  
Work in  
Dundas

There has been carried on by our agriculturist, Mr. F. C. Nunnick, under the direction of Dr. Robertson, during the last year, a continuation of the work in Dundas county, to which I referred in my last annual address—a work which I take this occasion of repeating is, in my judgment, one of the most important enterprises undertaken by this Commission. The work in Dundas county has been directed to the advancement of illustration work upon sixteen illustration farms, and has dealt with the planning and rotation of crops, seed selection, use of fertilizers, classification of live stock, economies in the use of farm labour and machinery, business methods in selling,

additional work through schools, school gardens, home gardens, boys' and girls' clubs and school clubs.

**Details of Work** It was found at the outset that great need existed for more attention being paid to the question of seed, and upon each of the illustration farms this subject has received attention. Different methods of cultivation have been put into effect, and the use of fertilizers is being studied.

A particular development of the work has been the encouragement of gardening, which has been neglected by the farmers of Eastern Ontario to an extent that is almost incredible. It is hardly possible to realize the lack of knowledge of proper gardening methods which exists amongst the farming population of certain portions of the country, and there is no branch of work where as speedy and valuable results can be secured without the least possibility of failure as in the improvement of gardening.

Only one per cent of the farmers of Dundas county was found to follow a satisfactory method of farm accounting. A proper system of accounting has been installed on each of the illustration farms, the result of which will show where profits are made and where losses are incurred, and will be valuable and educative with respect to the rest of the community.

The principle of co-operation is the foundation of the improvement of agricultural conditions in Ontario, and this has been adopted and encouraged. A breeders' club has been formed, and arrangements are being made for auction sales of pure bred stock and for a county stock show and sale.

**Agriculture in the Schools** The teaching of agriculture in the rural schools of Ontario is optional. Previous to 1916, comparatively few of the teachers in Dundas county were giving instruction in agriculture. During 1917, the number was increased until the subject was taught in 76 out of the 78 schools of the county. Twenty-eight school teachers from Dundas county attended the summer agricultural course at Guelph in 1917, while 13 was the largest class from any other county. Under the auspices of the Ontario Department of Agriculture, four very successful rural school fairs were held. A considerable increase in the number of home gardens and school gardens in the county has also been brought about.

An automobile excursion from the county to the Experimental Farm at Ottawa was organized, and about two hundred farmers and horticulturists made the trip. The day was spent in study of various operations conducted upon the farm. Meetings have

also been held in various portions of the county. There is an active horticultural society at Winchester, and plans are under way for the organization of a society at Morrisburg. A tractor demonstration was held at Chesterville on October 31.

**Co-operation and  
Self-reliance**

I entertain the very strongest belief that through the work thus being done in the county of Dundas, we shall in the course of a few years be able to point the way to permanent improvement of agricultural conditions in Ontario. The basis of all such improvement must be co-operation amongst the farmers themselves for scientific instruction in regard to the best methods of improving production. Success depends upon the appreciation by the farming community that improvements depend upon themselves, and that, given the necessary scientific aid and instruction, they must themselves co-operate and carry on the work in the same manner as men engaged in any other line of business. The unfortunate feature of farming in Ontario, and in Canada generally, has been that each individual farmer has jealously regarded himself and his farm as a unit separated from the rest of the community and to be managed without any reference to the views or interests of any other person. As a result, we have found that agriculture only advanced to a certain point. Then progress ceased, and for some years past in the Eastern provinces agriculture has been at a standstill, if it has not retrograded. The problems of supplying and handling farm labour, of securing proper scientific instruction, of improving knowledge of gardening methods, of insisting on proper teaching of agriculture in the schools, of proper study and development of the stock industry as applied to the particular locality, are all questions which can only be solved by co-operation amongst the farmers themselves. Lastly, the fundamental questions of co-operative buying and co-operative selling are those which furnish the solution for the most serious difficulties with which isolated farmers have to deal. It is my hope that the full development of the idea which we are applying in the county of Dundas may have most important practical results.

#### MINERALS

Inasmuch as the fuel question is to be discussed otherwise, my reference to this subject will be somewhat brief.

**Lignites for  
Fuel**

War conditions have brought home to the people of Canada the critical position in which they stand with regard to fuel and the necessity for applying intelligent study to the whole question. Some consideration has

been given by the Mines Branch, of which Dr. Haanel is the director, and the Advisory Council for Scientific and Industrial Research, to the greater utilization of the lignites of the West, and our mining engineer, Mr. Dick, has worked out the comparative probable cost of briquettes made from lignite and of anthracite coal. The difference in favour of the briquettes as compared with anthracite from the United States varies from 45 cents a ton in Portage la Prairie to \$2.50 at Moose Jaw. It is to be noted that no more valuable conservation work could be done than the establishment of a briquette-making industry as it would retain the whole of the large sum now paid for United States anthracite and cause it to be devoted to carrying on a Canadian industry.

**Incompetency  
and Waste**

Upon the whole question of coal Canada is woefully behind the times. Dr. Adams, the chairman of our Committee on Minerals, a considerable time ago, after studying the question, moved for the appointment of an inspector of mines in Western Canada. This proposition was laid before the Government and it concluded to make the appointment. Instead, however, of consulting Dr. Adams and the Committee on Minerals in making the appointment, the Government made an appointment which it can only be said was entirely inadequate and unsatisfactory. It still remains a fact that wasteful methods of mining are permitted throughout western Canada. No serious attempt has been made to grapple with the problem of preventing the serious and irreparable waste which is constantly going on in the mining of our western coal areas. Provision for inspection to prevent the loss of human life has been made by the provinces; but the permanent waste of very large quantities of valuable coal still goes on. What is required is a competent public service of technically trained men who will undertake the supervision and control of the mining of coal upon Dominion lands and put an end to the waste which is going on at the present time.

In another respect, we are, as I have frequently stated, greatly to blame for pursuing wasteful methods. There are in the Dominion of Canada at the present time approximately 2,600 coke ovens. Of these, 910 only are by-product ovens. The rest, amounting to about 1,700 ovens, convert the coal into coke without saving the by-products. We are thus using coal in the most wasteful way and throwing away great sources of wealth.

**Nickel  
Industry**

It is most gratifying to be able to record that, within the last two years, there has been a development of the greatest importance with regard to the subject of conservation of mineral wealth. At our first annual

meeting, attention was called to the fact that, though possessed of the richest portion of the world's supply of nickel, we were deriving only a comparatively small amount of benefit from it. The most expensive portion of the work of recovering nickel from the raw ore was done in other countries. This anomaly is now in course of being remedied. As the result of constant agitation and discussion, we are likely to see by far the greater part of the work done in Canada.

The British American Nickel Corporation's new smelter and refinery are under construction near Sudbury, and are about one mile distant from the company's principal mine—the Murray mine. The smelter will produce a matte carrying 80 per cent copper and nickel. This matte will receive final treatment in the refinery. The plant will have capacity to treat 2,500 tons of ore per day and a nickel production of 20,000,000 pounds of nickel per annum. Power will be obtained from the Ontario Hydro-Electric Power Commission and all machinery will be operated by electricity. Owing to war conditions causing great scarcity of labour and rendering it extremely difficult to get supplies, the plant will probably not be in operation before the summer of 1919.

The International Nickel Company is constructing a nickel refinery at Port Colborne, Ontario, thus obtaining rail transportation and water transportation *via* the Welland canal. Construction work is well advanced, and it is expected that it will be in operation in a few months. The estimated cost of the plant is \$4,000,000. The initial capacity of the plant will be 15,000,000 lbs. of nickel per annum, but it has been designed for expansion to 30,000,000 or even 60,000,000 lbs., within a few years. The company has stated that the new plant will be able to supply the needs of the British Empire. The Orford Company's plant, at Constable Hook, New Jersey, will supply the United States.

The question whether the requirements for export to other countries shall be permitted to be refined outside of Canada will require further attention from the governments of the Dominion and Ontario.

Molybdenum      The demand for molybdenum for use in the manufacture of special steels has greatly stimulated prospecting and development of our molybdenite resources. Numerous discoveries have been made which vary in importance from mere mineral occurrences to deposits which have already given rise to considerable production. The most important deposit yet proven is that near the village of Quyon, Quebec.

The Federal Department of Mines has done much to encourage the concentration of these ores. After trial shipments had been made for test runs in the United States, the ore from Quyon mine was principally sent to the concentrating plant of the Mines Branch. The company has recently completed a concentrating plant to take care of its output.

Magnesite      The establishment at Shawinigan Falls of an electrolytic process for recovering metallic magnesium from magnesite has stimulated the production of this mineral. Magnesium is used in connection with the war for the manufacture of star shells and flares, and as an alloy with aluminium for the manufacture of aeroplane parts.

In addition to the above, production of the following minerals and metals has been stimulated by the war: copper, nickel, asbestos, zinc, silver, lead, chromite, cobalt, pig iron, and graphite.

Flotation Process      A method of concentrating ore, known as the flotation process, has sprung into very great importance of late years, and an acute situation has arisen in Canada within the last few months with respect to the use of this process.

The process has developed within late years to such an extent that it is said that over 100,000 tons of ore are treated every day in the United States by it. It is becoming known in Canada and has been largely introduced. Undoubtedly, the process can be used much more extensively in Canada with great profit. A company, known as the Minerals Separation Company, claims to be entitled to all rights to this process, and it is said that this company is making exorbitant and unreasonable demands with respect to the use of the process. A Washington dispatch quotes the Journal of American Mining Congress as follows:

"It, that is the Minerals Separation Company, demands that its licensees shall give it the full benefit of any invention or discovery made by them which may be an improvement or modification or addition, and the right to patent such inventions for the company's own use, and further requires the licensees to bind their employees in the same way. Its licensees are also required to pay a royalty which, it is claimed, is computed in an entirely unsatisfactory way."

It is claimed that the royalty which the company desired to collect from the Cobalt mines is in excess of the total revenue derived by the government from the taxation of these mines.

Apart from the legal and financial questions, under present circumstances, the claims which are being made undoubtedly tend to interfere with production of essential minerals, and, therefore,

are a detriment to our operations in connection with the war. It is not my province to express an opinion in regard to the merits of the dispute which has arisen or the suggestion that the Minerals Separation Company has alien enemy affiliation, but I have no hesitation in saying that the whole case is one which demands prompt and careful examination by competent and unprejudiced authority on behalf of the government in order that the situation may be satisfactorily cleared up. I am told that the Canadian patents of the Minerals Separation Company are all granted under Section 44 of the Patent Act. An examination of this clause makes it quite clear that it, in connection with Section 52, gives the government quite sufficient authority to take any action which may be determined to be at once just and in the public interest.

When the question is dealt with it should not be dealt with simply from the standpoint of the Cobalt mines. The question should be definitely settled in its application to the whole of Canada, so that the mining industry will know exactly where it stands with regard to this most important matter.

**Electric Smelting** Shortly after Dr. Haanel, the present Director of the Mines Branch, became connected with the public service at Ottawa, he was authorized to make an investigation into the question of electric smelting. The investigation was conducted in a most thorough and scientific manner, and its results were published in a report which has become a standard work in all technical libraries which aim to keep on their shelves up-to-date works upon modern industrial processes. At the time when this investigation was made, the general opinion prevailed that, while the investigation was interesting, the time was very distant when electric smelting would be carried into practical operation in Canada. It was regarded as more or less of a fad; by some newspapers as somewhat of a joke. It is, therefore, worthy of special mention that the fruition of the efforts which were made in connection with that investigation has arrived and that electric smelting is now in full operation in Canada. Nothing could better demonstrate the usefulness of such scientific investigations when properly carried out.

There are, at the present time, 32 Heroult electric furnaces in Canada and 22 of other types—in all 54 furnaces using the electric process. These furnaces have a capacity of 173,000 tons of iron and steel, 50,000 tons of ferro-silicon and 8,000 tons of other ferro-alloys per annum. The British Forgings plant at Toronto has 10 electric furnaces of the Heroult type and a total capacity of about

72,000 tons per annum, making it the largest electric process steel plant in the world.

**Steel for  
Shell Making**

An interesting development has also taken place with respect to steel for shell making, which has an important bearing on conservation. At the beginning of the war, all shells manufactured in England were made from *acid* steel. Practically all steel made in Canada was *basic* steel. The Canadian steel manufacturers had never made shells. It was not absolutely certain that they could meet the requirements of the War Office, and changing from the manufacture of acid to basic presented many serious difficulties. Col. Cantley, with whom the first shrapnel shell order was placed, made a basic steel shrapnel shell that met the War Office requirements and thus demonstrated its practicability. In December, 1914, Col. Carnegie, Ordnance Adviser to the Imperial Munitions Board, took to the War Office the first machined shell ever made in Canada. Later, he was able to convince the War Office that high explosive shells made of basic steel would also meet their requirements.

These munition orders have tremendously stimulated the metal and many other industries, notably the recovery of by-products from the coke oven plants. Incidentally, also, we have derived great benefit from the standardizing of methods and processes and the high degree of skill required to produce a product that is gauged to within one three-thousandth part of an inch and check-gauged to one ten-thousandth part of an inch. Over 250,000 workers have become skilled in such processes and in the use of such tools and gauges.

#### FIRE-WASTE INVESTIGATION

In my last annual address, I referred to the question of fire waste investigation. The report is now in the hands of the printer and will be issued at an early date.

**Conclusions  
Reached**

For your benefit, I have summarized the conclusions:

(1). Fire losses in Canada are chiefly due to (a) individual carelessness, (b) poor structural conditions, (c) arson. About 70 per cent are believed to originate from the first cause.

(2). Fire losses can be materially reduced by attacking the problem at its source. Experience shows that, by the enforcing of proper fire prevention and protection measures, an immediate and enormous reduction in the fire loss can be made.

(3). It is perfectly clear that property owners in Canada are not sufficiently influenced by their own interests to use effective means, and compulsion must therefore be resorted to.

It has been shown that public efforts and propaganda without compulsion will not bring about any substantial improvement. Municipalities organize and maintain fire departments, and incur large expenditures for water supplies, but the results of these activities are disappointing. Fire waste not only continues but increases.

Legislation Needed      Existing conditions in Canada point to the need of legislation on the following lines:

- (1). Proper planning and laying out of cities and towns with the object of restricting hazardous pursuits to certain delimited areas.
- (2). Provision of adequate water supplies and fire-fighting facilities.
- (3). Proper building requirements.
- (4). Control of hazards and suppression of dangerous nuisances, close inspection and ruthless enforcement of regulations.
- (5). A fire marshal law of the strictest character.
- (6). Enforcement of personal liability, with heavy penalty where negligence is proven.

Behind Other Countries      It has been conclusively shown by the experience of England and other European countries that proper measures of prevention have immediately beneficial effects, but in Canada we have not taken any such steps. Losses do not diminish. They increase. During the four years from 1912 to 1915, the average fire loss was \$21,250,000 per annum. In 1916, the loss was \$25,400,000. The 1916 figure will be exceeded during the present year. Fires are not gaining in frequency. The increased destruction is due to appreciation in values and to extensive fires. As an indication of the difference which exists in countries where proper precautions are taken, the total loss by fire in the whole of the United Kingdom, apart from fires caused by the enemy, amounted from August, 1914, to December, 1916, to \$41,000,395. During the same period, losses in Canada, exclusive of forest fires, amounted to \$52,027,000. These figures discloses a situation which calls for active and vigorous measures of prevention, and we shall continue to call attention to them until some steps are taken to apply a remedy.

#### PRESS AND CO-OPERATING ORGANIZATIONS

This branch of our work has been active as usual and through its practical results are obtained by steady and informative propaganda. Members of the staff have delivered many addresses to public and other bodies on the work of the Commission. The newspapers and other publications have readily given their space to assist in the circulating of information. There is an increasing recognition

of the value of the measures which we are advocating, and consequently an increasing willingness to advocate these measures through the columns of the press. In fact, we find more people who are willing to adopt our ideas than we do people who are willing to take the trouble to understand them. In striving after reform, the greatest difficulty to be overcome is the inevitable inertia of those who are required to understand what is to be reformed.

During the past year, Mr. Adams' report on *Rural Planning and Development* has been published, and there are now in the press reports on *Fire Waste in Canada* by Mr. J. Grove Smith, *Water-powers of British Columbia* by Mr. Arthur V. White, and *Forest Resources of British Columbia* by Dr. Whitford and Mr. R. D. Craig. A number of other reports are in course of preparation. The work of the editorial staff is much hampered by the fact that some of its members have gone overseas. Nevertheless, upon the whole, the work has been carried out with a fair amount of satisfaction.

Apart from the work done by the regular staff of the Commission, special mention is due to a report which Dr. C. Gordon Hewitt is preparing for us entitled *Conservation of Wild Life in Canada*. Dr. Hewitt's valuable scientific work is well known throughout Canada and he has devoted a great amount of time and attention to the forthcoming review of Canadian wild life. It will be the first comprehensive and authoritative publication of its kind.

#### TOWN PLANNING AND CIVIC IMPROVEMENT

It gives me great pleasure to be able to announce that Mr. Thomas Adams, who has been with us for the last three years, has consented to renew his engagement for another period of three years. During the past year, he has accomplished a great deal of important work, much of which was accomplished through the agency of civic improvement leagues. The Ottawa league has engaged the attention of a number of our most public-spirited citizens and is pursuing its work with some success. A conference on urban and rural development in conjunction with the annual meeting of the Dominion League was held in Winnipeg in the month of May. Representatives from all over Canada were present at this meeting. Reports indicated that much progress had been made by civic improvement bodies throughout Canada, and the meeting at Winnipeg will undoubtedly impart a fresh impetus to the movement.

New Dept. of Municipal Affairs      On February 9, a deputation attended upon the Premier of Ontario to urge legislation in connection with town planning and the establishment of a department of municipal affairs. Suggested improvements in the

law were specified, and it is gratifying to be able to say that the legislature, at its last session, passed an Act establishing a Department of Municipal Affairs. There is no reason to doubt that a substantial beginning in the work of civic improvement has been made.

**Town Plans  
Prepared**

The following plans have been prepared, namely:

Pulp and Paper Company, a new set of plans for the town of Renfrew, a draft scheme for the city of St. John and a general survey of the surrounding area with special reference to the lines of communication.

Consultation is going on with the Saskatchewan government over the draft town planning act, and an effort is being made to have the act made as comprehensive as possible so as to include rural development and the planning of farm land in connection with settlement.

**Rural Planning  
and Development**

The main publication of the year in this branch has been Mr. Adams' book on *Rural Planning and Development*, which has met with a very gratifying

reception by the press. The second volume of the series, *Urban Planning and Development*, is now in course of preparation, and will be followed by a third, which will set forth in detail methods for dealing with conditions as explained in the preceding volumes. A report on the housing conditions in Ottawa is in course of preparation and is expected to furnish valuable data to the Ottawa Civic Improvement League in connection with its work.

#### WATERS AND WATER-POWERS

**Electric Power  
Plants**

We have now practically completed the preliminary survey of the water-powers of Canada. The results have been published with respect to every province except British Columbia, and the report for that province is in the printer's hands. During the past year, special efforts were made to secure detailed information with regard to electric power plants and systems throughout the Dominion. It is of great practical importance in a country where advances are so quickly made that such information should be accurate and up to date. The report which is now in progress will completely cover this branch of the subject. The members of the staff who are specially charged with the branches of the work will give their reports to the Commission in detail, and it is not necessary for me to anticipate what they will say. I purpose, however, saying a few words on the general features of the subject of hydro-electric power.





LONG SAULT RAPIDS,  
ST. LAWRENCE RIVER  
A head of about 35 feet is capable of development here.

COMMISSION OF CONSERVATION

**Power Progress  
in Ontario**

The development of hydro-electric power in Canada, and especially in the provinces of Ontario and Quebec, during the last ten years has been almost incredible. At the beginning of the work of the Ontario Hydro-Electric Power Commission, the late premier, Sir James Whitney, stated that the Commission would not require so much as 10,000 h.p. At this moment, the immediate requirements of the Hydro-Electric Power Commission in Ontario may be conservatively stated at 296,000 h.p., upon which demand there is a present shortage of about 70,000 h.p. A conservative estimate of the amount of power actually in use in the city of Montreal and its environs, is 225,000 h.p. The position with respect to the province of Ontario, and especially with regard to Niagara falls, is one which should be considered with great care. At the present time, the Hydro-Electric Power Commission is about 70,000 h.p. short, and it is not too much to say that this shortage will very rapidly increase. I understand that Sir Henry Drayton has reported to the Federal Government that it is not practicable to withdraw this 70,000 h.p., which is presently in demand, from the United States to which it is now being exported, for the reason that the power is necessary for the use of plants which are producing essential war material for Great Britain and her allies. The position is, therefore, that, whereas, 12 or 15 years ago, it was not thought that the Hydro-Electric Power Commission could make use of 10,000 h.p., and, accordingly, permits to export were more or less freely given, there is now, in round figures, an immediate demand for 300,000 h.p., and the demand cannot be satisfied.

**St. Lawrence  
Power  
Situation**

A situation analogous to that in which Niagara power stood fifteen years ago, now exists on the St. Lawrence river. A very large capacity for the development of power exists upon the St. Lawrence. There is a considerable development in the neighbourhood of Montreal, but the greater portion of the power still remains undeveloped. Attempts are constantly being made to fatally complicate the position with respect to St. Lawrence power by securing the privilege of private development, which will be followed by contracts for the exportation of the power developed. I understand that the Cedars Rapids company exports something like 60,000 h.p. per annum. An attempt was made some years ago to secure the privilege of developing the Long Sault power, the purpose being to export the greater portion of the power in the interest of a manufacturing corporation on the United States side of the line. This project was defeated, largely through our efforts. A similar project is now being promoted,

and we are resisting it with all our energy and we trust with fair prospects of success. It is almost incredible that any responsible man should be so short-sighted as to favour this project in the face of the experience which we are now undergoing at Niagara.

International  
Development  
Proposed

Within a very few years, there will be a demand for every horse-power that can be developed on the St. Lawrence river to which Canada is entitled for use

upon the Canadian side. The situation with regard to Niagara will undoubtedly be duplicated, and if we are foolish enough to allow vested interests to be created upon the other side of the line, we shall inevitably find ourselves handicapped and embarrassed as we now are with respect to Niagara power. For myself, I have no doubt at all what ought to be done with respect to the great powers dormant in the St. Lawrence river. The United States government is not interested in the corporations that are endeavouring to get possession of the St. Lawrence powers from the other side. Neither is the Canadian government interested in the fortunes of the gentlemen who are promoting their projects on the Canadian side. They are very few in number, and their interests are confined entirely to themselves. What the United States government and the Canadian government alike are interested in is that there should be a fair division of this power, that it should be developed in such a way that the neighbouring and tributary population should have the use of it upon fair terms. A thorough study of the whole question inevitably leads to the conclusion that there is only one sound and satisfactory method of developing these powers, and that is by an international commission, under which the greatest and the best use of the powers will be made, the most economical development will be effected, a just and equitable division of the power will take place and the governments concerned will be able to administer the power as the Hydro-Electric Power Commission administers the power of Niagara for the benefit of the people who are directly concerned in its use.

Not Public  
Ownership

This bold and progressive policy, if adopted by the government of Canada, will undoubtedly command

the support of our people. It is not a case of advocating what is generally described as public or government ownership. We have here a peculiar set of circumstances giving rise to a problem that is capable of being solved in only one way, and common sense indicates that we should solve it in that manner.

A Word of  
Warning

Let me on this point add a word of warning. The institution of this Commission of Conservation arose as one of the consequences of a conference which was called by Mr. Roosevelt, then President of the United States,

at Washington, some time ago. At or about that time, Mr. Roosevelt pointed out in prophetic language how the people of the United States were being threatened with a water-power monopoly, and to the best of his ability he projected methods of resisting the efforts which were being made to bring about that monopoly. Since that time, water-powers have been monopolized in the United States to an extent that is almost incredible. I am not at the moment able to give the exact figures, but I think that when the real figures are known, revealing the extent to which the available and easily developed water-powers of the United States have been monopolized by a very few corporations, the people of that country will suffer a shock such as they have never experienced before with regard to the transaction of any of their public business. It has become very plain within the last few years that hydro-electric power is the greatest of all factors in modern industry, and where any people endowed by nature with a vast supply of this essential element in modern manufacture, allow it to be monopolized and controlled in private interests a sad awakening awaits them.

Danger of  
Monopoly

Fortunately in the Dominion of Canada, we got down to serious business in time, and there has been no serious monopolization of great powers. While large powers have been developed by private companies, they have served a very useful purpose, and, in most cases, their rates have been reasonable. A serious danger, however, would arise if, at that stage of development which we are now entering, these companies were allowed to combine their interests and, by acquiring a few great powers which are easily accessible, to institute a monopoly. This would be the most serious of all mistakes and must be prevented at any cost.

With respect, specifically, to the application which is now before the Minister of Public Works for leave to dam the St. Lawrence river at the Coteau rapids, I purpose suggesting that our Committee on Waters and Water-powers should give the matter attention and, if possible, wait upon the Minister of Public Works and the Prime Minister to emphasize the protest which has already been lodged.

#### GOVERNMENT WATER CONSERVATION UNDERTAKINGS

With respect to the conservation of water-powers generally, I am able to note several enterprises of great practical importance which show that progressive policies are being carried into effect.

**Ottawa River Storage**

Over half a century ago, it was urged that the construction of dams on the upper Ottawa would be of great benefit to power users at the Chaudière falls, Ottawa. Between 1904 and 1908, detailed surveys of the proposed Georgian Bay Ship canal *via* the Ottawa, Mattawa and French rivers were made. These surveys demonstrated the value of conservation dams at several points, notably at the outlets of lake Timiskaming, Kipawa lake and lac des Quinze. The construction of the three dams mentioned was completed in 1915 and the water-power interests have been much benefitted by their operation, particularly during the winter of 1916-17 when the low-water flow was increased by letting out the storage water.

These reservoirs can supply an additional flow of 10,000 cu. feet per sec., thus increasing the total power possibilities between Mattawa and Carillon by some 400,000 h.p., while at Ottawa alone, where the water is being fully utilized, the increase is approximately 30,000 h.p.

**La Loutre Dam,  
St. Maurice  
River**

The most important water conservation work thus far undertaken in Canada is that undertaken by the Quebec Government and now nearing completion at La Loutre on the St. Maurice river. It will store up the waters of the St. Maurice for the benefit of its many water-powers and will double the low-water flow.

This work had been projected for many years, as the regulation of the river is of the greatest value to the important developed water-powers at La Tuque, Grand'mère and Shawinigan Falls, but no construction work was undertaken. After full investigation of the project, both from the physical and financial view-point, the Quebec Streams Commission let the contract for construction in the summer of 1915.

The work has since progressed steadily in spite of the great difficulties in transportation. It is now 80 per cent completed and will cost about \$1,500,000. When finished, it will create a reservoir of 160,000 million cu. feet, forming the third largest artificial reservoir in the world, being exceeded only by the Assuan reservoir on the Nile and the Gatun lake on the Panama canal. From the owners of the power-sites already developed, the Commission will receive a revenue of upwards of \$130,000 per annum.

Between the reservoir and the mouth of the St. Maurice there are 17 power-sites with heads of from 10 feet to 150 feet. The aggregate descent at these sites totals 800 feet but the dams erected in developing the various sites will increase this total head to 900 feet. Under present conditions, these sites have a total capacity

of approximately 350,000 theoretical h.p., but it is estimated that some 900,000 h.p. will be available when the flow is regulated from the reservoir. At Shawinigan, Grand'mère and La Tuque alone, the three sites at present utilized on the St. Maurice, the potentiality will be raised from an aggregate of some 190,000 theoretical h.p. to over 400,000 h.p.

**St. Francis  
River  
Storage**

Another water storage undertaking of the Quebec Streams Commission, now nearing completion, is the St. Francis River dam at the outlet of lake St. Francis, the lake being used as a reservoir. Contracts for the construction of the work were awarded in September, 1915. As the majority of the power-sites on the St. Francis are actually developed and, as the power-owners have suffered from insufficient water for a number of years, this work will afford much-needed relief. It is estimated that revenue from the use of the conserved water will cover all overhead charges and maintenance costs.

By raising the level of the lake 15 feet, the reservoir will have a capacity of 12,200 million cu. feet, and will increase the flow at the outlet from the natural minimum of 100 cu. feet per sec. to 600 cu. feet per sec. The corresponding total power increase on the river will be 21,810 h.p., of which 6,000 h.p. will immediately be absorbed by the present users, while the development of the remaining sites will be greatly facilitated.

**Trent River  
Conservation**

An extensive system of small conservation reservoirs has been established in connection with the canalization of the Trent river. These serve the double purpose of supplying the canal system and supplementing the minimum flow in the river for power purposes. There are four hydro-electric plants on this river supplying the Central Ontario system of the Ontario Hydro-Electric Power Commission and these are benefitted by the regulated flow in the river. Some of these plants have a capacity as high as 8,000 h.p.

Dams have been built at the outlet of many lakes on tributary streams and the water is stored until required in the dry summer and autumn for navigation and power purposes. The control of the flow is being constantly improved by the further utilization to the fullest extent of the natural storage basins of the Trent valley.

**Grand River  
Valley**

It has for some years been a matter of public knowledge that the Grand River valley in the province of Ontario is suffering more and more from a diminished flow in that river. I am not able to give an expert opinion upon the subject from an engineering standpoint, but it

seems clear that the time has arrived when the Ontario government should make a thorough scientific examination of the subject with a view to ascertaining whether conservation works can be constructed which will remedy the evil. The experience of Quebec shows that where these works are practicable they can be constructed without placing any burden on the public exchequer.

When the Commission was organized, one of the first tasks that we set before ourselves was the preparation of an adequate and satisfactory directory of natural resources. It very soon became evident, however, that such a directory would have been fragmentary and unsatisfactory in many respects and that much information which it ought to contain was not at that time available. The researches and investigations of the past years have now put us in a position to realize the intention which has been entertained from the beginning and which, indeed, was one of the objects we had in view at the inception of the Commission's work. We shall, therefore, proceed now without further delay and undertake the preparation of such a directory and inventory of the natural resources of Canada as will satisfy the lack which has so long existed.

SIR CLIFFORD SIFTON: There can be no doubt at all from the facts which we now have in our possession that the fuel question is one of the most serious the people of Canada have to face. The situation is so serious that the Government has appointed a Fuel Controller and we expect to have a statement from him at this meeting, which will give us a clear idea of the real position of the fuel question in Canada at the present time.

We have hardly realized that a great portion of Canada has practically no coal at all for fuel, and is absolutely dependent upon importations from the United States. I do not think the people of Canada have really faced that fact or have allowed themselves to realize what it means as yet; but undoubtedly they will have to face it, and as a body whose duty it is to intelligently anticipate problems of this kind, it is our duty to consider these questions and bring them to the attention of the public. We are, therefore, to have an address this morning from Dr. Eugene Haanel, Director of the Mines Branch, on *Peat as a Source of Fuel*. I shall now call on Dr. Haanel.

## Peat as a Source of Fuel

BY

EUGENE HAANEL, PH.D.  
*Director, Mines Branch*

ON former occasions, when I addressed the American Peat Society, the Canadian Club at Toronto, and the members of this Commission, on the subject of the utilization of our Canadian peat bogs, the conditions prevailing throughout the country were totally different from what they are now. Then the country enjoyed peace and prosperity, and the spirit of *laissez faire* rendered efforts to arouse an abiding interest in the development of the peat resources of the country unavailing.

Now we are in the throes of a gigantic war, entailing colossal destruction of resources, and our minds are agitated with the question: "How can failing resources be replaced by others?" and, perhaps for the first time, compelled by the exigencies of the times, are we prepared to realize that the natural resources upon which the very foundations of our present civilization rest, and upon which future civilization must continue to build, are not inexhaustible, but limited, and that for some, it is feared, exhaustion is in sight. This is the case with fuel, of which class coal is the most important. How to conserve it by utilizing a maximum of its potential energy is a problem of the utmost importance wherever coal is the principal fuel.

A Possible  
Fuel Famine

But in countries where artificial heat must be provided for eight months annually for the sole purpose of maintaining life, the question of an adequate fuel supply is overwhelmingly important. This is brought home to us as never before, and the appointment of a Fuel Controller for Canada and a similar officer for the United States demonstrates that conditions may arise when, in spite of still abundant coal resources, a fuel famine may occur. The possibility of a shortage of fuel to meet the demand of the central provinces of Canada, which depend upon the United States for some 17,500,000 tons of coal, annually, and the probable suffering which may be entailed by such shortage have produced a profound change in the mental attitude of the people, rendering them more willing to consider, soberly and seriously, the fuel problem of the central provinces of Canada.

The difficulty regarding an adequate and cheap fuel supply which we are facing now, due to war conditions, may be less pressing, but will not vanish, after the war. The coal deposits of the east and west in Canada will still be too far from the central provinces to supply them with cheap fuel, and we will still be dependent upon the United States for the very means of keeping ourselves alive; for we have made no provision to meet an emergency arising from a shortage of fuel due to labour conditions in the United States, either by laying in stocks of fuel to carry us over the period of shortage, or by having developed and in active operation plants strategically situated to furnish an excellent substitute for coal—peat. Moreover, we can not be altogether certain that the United States will be able to continue to supply us with the amount of coal we have been receiving annually from that country. The war may reveal to their Government the necessity of husbanding their fuel supply, and they may therefore limit or altogether prohibit export of it in the near future.

The gravity of the fuel situation, as I see it, and the momentous problems presented by it, are my excuse for coming before the members of this Commission a second time to address you on the subject, "Peat as a Source of Fuel."

#### PEAT RESOURCES OF CANADA

The total area of the Dominion of Canada overlain by peat bogs is estimated to be 37,000 square miles, and of this total area the known peat bogs of Manitoba, Ontario, Quebec, and New Brunswick comprise 12,000 square miles, with an average depth of 6 feet. This is probably but a portion of the actual amount of this valuable fuel asset in existence in these provinces.

One square mile of peat bog with an average depth of 6 feet will produce 774,000 tons of peat fuel, with a moisture content of 25 per cent. The 12,000 square miles will, therefore, contain about 9,300,000,000 tons of peat, having a fuel value equivalent to about 5,400,000,000 tons of good coal. This calculation is made on the assumption that the total quantity of peat contained in the 12,000 square miles is suitable for fuel purposes. This assumption is not strictly correct, but is near enough to serve the purpose of illustrating the enormous potential energy stored in our peat deposits.

**Exact Data  
re Deposits**

Up to the present time, the Mines Branch has located, delimited, mapped, and investigated, as to depth, character, and quantity of peat available for commercial exploitation as fuel or litter, peat bogs comprising approximately 175,000 acres. Of this total amount, published

reports treat in detail about 140,000 acres distributed as follows: Ontario, 25 bogs; Quebec, 12; Nova Scotia, 8; Prince Edward Island, 6; and 7 in Manitoba; making 58 in all. These bogs are estimated to be capable of producing 115,000,000 tons of fuel, and 10,500,000 tons of peat litter.

Seven bogs within convenient shipping distances of Toronto are estimated to be capable of producing approximately 26,500,000 tons of fuel; and seven bogs in the vicinity of Montreal could supply that city with 23,500,000 tons of fuel.

Five bogs along the lower St. Lawrence, conveniently situated as regards water transportation to the city of Quebec, can, it is estimated, supply 16,250,000 tons of fuel, and 5,700,000 tons of peat litter.

The bogs examined in Nova Scotia can produce 6,200,000 tons of fuel and 500,000 tons of peat litter, and those of Prince Edward Island can produce 1,250,000 tons of fuel and over 1,000,000 tons of peat litter.

Manitoba is rather poor in peat fuel bogs, the aggregate fuel content of the bogs of that province being estimated at less than 2,000,000 tons. One bog alone, however, it has been estimated, is capable of furnishing 2,500,000 tons of peat litter.

#### MANUFACTURE OF PEAT FUEL

##### Extracting the Moisture

Peat, in its natural state, is generally associated with about nine times its weight of water, and before the combustible matter, amounting to about ten per cent, can be converted into a fuel, the greater portion of this water must be removed. The water content of a bog is slightly reduced by a conventional system of drainage, but the remaining water, amounting to about 86 per cent must be removed by other means. The excavation of the peat, whether accomplished by hand or automatic machinery, does not present any problems of a difficult nature. The handling of the excavated material, containing about 90 per cent water, and the removal of this large quantity of water constitute the real problems with which peat engineers are confronted. Numerous attempts have been made to remove the water mechanically by hydraulic pressure, and to evaporate the water by means of artificial heat. Other attempts have been made to alter the chemical constitution of the peat substance—by wet carbonisation—in such a manner that it would more readily part with its water content through the agency of pressure, but none of the attempts made in this direction have, so far, been successful. It

has been demonstrated once and for all that the water content of raw peat cannot be reduced much below 80 per cent by pressure alone, and the process of wet carbonizing, upon which large sums of money have been expended, has not, up to this time, proved a success. In fact, it may be safe to make the statement that any process for the manufacture of peat fuel which depends upon the employment of artificial heat for the evaporation of the moisture will not prove economic.

Drying by Sun and Wind      The only economic process in existence at the present time is that which utilizes the sun's heat and the wind for the removal of the moisture. Such a process, it will be understood, can never be continuous, but is absolutely dependent on weather conditions. Nevertheless, all the peat fuel manufactured in European countries, and which amounts in Russia, the largest peat producing country, to 7,000,000 tons annually, is manufactured in this manner.

The process which makes use of the sun's heat and the wind for the removal of moisture is known as the 'wet process,' and the product obtained is called 'machine peat.' This is the process which was successfully employed for the manufacture of peat fuel at the Government peat plant at Alfred, Ontario. Briefly stated, it consists in the thorough maceration or pulping of the freshly excavated peat, and the spreading of the resulting mass on a portion of the bog prepared for drying purposes. When the pulped peat, which has been spread on the ground to a thickness of 4 to 6 inches, has sufficiently set, it is cut transversely and longitudinally into blocks which, when dried to about from 30 to 35 per cent moisture, have approximately the dimensions of the ordinary building brick.

Pulping the Peat.      The operation of pulping or macerating serves to thoroughly mix the peat of the different layers or strata of the bog, thus forming a uniform product, and the fibres and roots, which are often found distributed throughout a peat bog, are cut, torn or ground into small fragments. But one of the most important results of this operation is the uniform distribution throughout the entire peat mass of a complex hydro-carbon compound, called 'hydrocellulose.' This is a gelatinous substance which serves the purpose of binding the particles composing the peat substance into a homogeneous whole.

It is believed by certain investigators that the great resistance exhibited by peat to parting with its water content, when subjected to pressure, is largely, if not entirely, due to the presence of this colloidal substance. But thoroughly decomposed fuel peat itself

may also possess to a certain extent the properties of a colloid. Whatever the resistance might be due to, the fact which concerns us is, that peat including this substance does part with its moisture when exposed to artificial heat or the action of the sun and wind. The latter is made use of in the only economic process known at the present time for the manufacture of peat fuel.

**The Colloid Skin**

During the drying period, the pulped peat mass contracts and thereby becomes more dense and resistant to breakage; in addition, the dried peat becomes more impervious to the absorption of moisture. When the drying process has been under way for two or three days, that part of the gelatinous substance above described, situated on the surface of the peat-block, forms a skin over it. This skin performs an important function in the drying process. It takes up the moisture from within and transmits it to the air surrounding the drying peat. During wet weather, the skin rapidly absorbs moisture until saturated. Since, in that condition, it can not take up more moisture, it protects the interior of the peat-block from absorbing moisture from without. When the rain ceases and the peat is again exposed to the heat of the sun's rays, the drying begins anew at the point where it was interrupted. Fresh peat-blocks which have not been protected by partial drying, as explained, on exposure to rain will be washed away and the blocks completely ruined. The drying operation is considered to be complete when the moisture content has been reduced to from 25 to 35 per cent.

Peat manufactured by this process is an excellent fuel. It will stand a large amount of handling without the production of much 'fines,' and when dried to about 25 or 35 per cent of moisture it resists, to a large extent, the re-absorption of moisture. This property permits the fuel to be stored in the form of stacks in the open field. Peat not dried down to 30 per cent should not be stacked for winter, since frost is ruinous to peat still in a wet state.

**A Practical Test**

Of the 3,000 tons peat fuel manufactured by the Mines Branch at the Alfred peat bog, 1,200 tons were distributed, at a nominal price, among the householders of Ottawa and the villages and small towns in the vicinity of the peat fuel plant, to give them an opportunity to try and accustom themselves to this new fuel. One hundred and fifty very favourable opinions regarding the value of this fuel, from those who have tried it, were collected by the Canadian Peat Society and published in their Journal. The following is a summary of the properties of peat manufactured as described.

**Properties of Peat Fuel**

Peat is a clean fuel to handle; has, as a rule, a very low ash content, and produces no soot or other deposit when burned in an ordinary cook stove or open fireplace. The ash, moreover, is in a very finely divided condition, free from combustible matter, and can be easily removed from the stove or fireplace. Clinkers are not formed. On account of the ready manner in which peat fuel ignites, often a little paper or a few shavings are sufficient to start the fire. A peat fire does not, therefore, require to be kept continually burning throughout the day, if not needed, since a new fire can thus easily be started when required.

Peat fuel, on the other hand, is more bulky than coal and is of lower heating value per pound. The relation between anthracite coal and peat fuel as regards heating value per pound is 12,500: 7,000, or 1.8, that is, one pound of the average anthracite coal is equivalent in heating value to 1.8 pounds of peat fuel, containing 25 per cent moisture. For a definite heating value, therefore, it is necessary to store 1.8 times the weight of the coal required in peat fuel. The volume occupied by the peat fuel, owing to its low specific gravity, will also be much larger than that of coal. One cubic foot of ordinary furnace anthracite coal weighs approximately 56 pounds, while one cubic foot of machine peat weighs about 27 pounds. The volume of peat required to equal coal of the above heating value will, therefore, be about 3.6 to 4 times that of the coal, which is a matter of considerable moment, and introduces serious problems when large quantities of fuel must be stored.

**NITROGEN CONTENT OF PEAT**

The numerous chemical analyses, representing very nearly all the typical peat bogs of the more settled parts of Canada, show that the average value of the nitrogen content is very high, and, in certain individual cases, the nitrogen content has been found to be exceptionally high. Peat, therefore, becomes a most valuable source of nitrogen for the manufacture of ammonia and other nitrogen compounds. This phase of the utilization of peat has been occupying the attention of investigators for many years, principally on account of the great demand for artificial nitrogenous fertilizers, and, latterly, on account of the demand for nitrogen products in connection with various chemical industries and munition works.

**Valuable as Fertilizer**

The civilized countries are beginning to recognize the importance of restoring to the soil the food elements which have been extracted, almost to exhaustion in certain cases, by the continual raising of the same

crops. One of the principal elements upon which plant life depends is nitrogen, and the amount of this element taken out by the crop must be returned to the soil if its fertility is to be maintained. Sulphate of ammonia is the most common nitrogen compound used for this purpose. In the past few years, the demand for this product has been increasing so rapidly that—*independent of the demand for nitrogen products, created by the war*—coking plants of the old style throughout nearly all the civilized countries are rapidly being converted into by-product recovery plants with a view of recovering the nitrogen content of the fuel in the form of ammonia. This ammonia is afterwards combined with sulphuric acid to form ammonium sulphate.

For the purpose of showing the large quantity of nitrogen which can be recovered from peat bogs in the form of ammonium sulphate, thirteen of the bogs so far examined in the province of Ontario, which have a total fuel content of 43,000,000 tons of 25 per cent moisture peat, and an average nitrogen content of about 1.8 per cent in peat of this moisture content, will be taken as an example. The content of nitrogen corresponds to 560,000 tons, and this will give 1,800,000 tons of ammonium sulphate, with the present day efficiency of recovery.

The nitrogen content of peat can be most efficiently recovered in the form of ammonia by burning the fuel in a by-product-recovery-producer-gas plant. The percentage of the nitrogen content of the fuel recovered by this process is much greater than obtains in the case of by-product-recovery coke ovens. In addition to the recovery of ammonia, a large quantity of gas is produced, which can be used for power or industrial purposes.

The quantity of peat used in the above illustration could, if all were burned in a by-product-recovery-producer-gas plant, produce sufficient power gas to generate approximately 40,000 h.p. continuously, day and night, for 100 years.

The extensive and varied field for the utilization of peat must be apparent to all who have closely studied this question, and the urgent need for an intensive development of the Canadian peat resources should be brought forcibly before men actively engaged in the building up of the great commercial enterprises and industries of this country.

#### PEAT FUEL FOR HEATING HOUSES AND OTHER BUILDINGS

This, in general, is an extremely difficult problem, if it be desired to retain the present heating systems, which are suitable only for coal.

**Central Heating Plants**

In the interest of the more efficient utilization of fuels in general, but peat in particular, for general heating purposes, the fuels should be burned in a central plant, either located at a bog or at a point near or in a city or town conveniently situated with respect to transportation facilities. In the case of peat fuel, which is the fuel under consideration here, the best results would be obtained if the fuel were burned in a by-product-recovery-producer-gas plant, in which the valuable by-products, including ammonium sulphate, could be recovered. The gas produced could be transmitted to the different houses and buildings in the same manner as the ordinary city gas, and burned in cook stoves, house heaters, etc., in place of coal, or steam could be generated in the central plant and the city heated by means of steam transmitted in mains laid underground. I understand that this method has already been employed in heating certain sections of Baltimore, Maryland.

This method of burning peat for heating houses and buildings would result in many economies, but principally in labour in connection with the attendance of individual heating plants, and in the distribution of fuel and storage of it in individual homes and buildings. Such a method would also eliminate the waste now taking place in isolated heating plants—especially homes—inasmuch as a central heating plant would have at its disposal a trained staff of engineers and labourers.

**COSTS OF PRODUCTION OF PEAT FUEL****Short Manufacturing Season**

The season during which the manufacture of peat fuel can be successfully conducted is limited to 100 to 110 days. This period may be materially lengthened when there is an early spring and late autumn, accompanied by moderately dry weather. It is, therefore, necessary, in order to manufacture a large output of fuel, that electric energy be employed to operate the plant. This will permit of the illumination of the bog by electric lamps, so that the operations, when weather conditions permit, may be continued during the night also. This method of operating will reduce the overhead charges, interest on investment, amortization, and repairs, by distributing the costs thus represented over a much larger output than would be the case with daily operation only.

The plant operated by the Mines Branch was supplied with hand-dug peat, and required for a daily output of 30 tons of 25 per cent moisture peat a complement of 14 men all told. But even under these unfavourable conditions, the result of the two seasons'

manufacturing operations indicates that, with efficient management, peat fuel can be manufactured at a cost of \$1.75 per ton on the field.

**Labour-Saving  
Machinery**

The employment of mechanical excavators and other labour-saving devices not only increases to a very large extent the capacity of the plant, but materially reduces the number of men required to operate the plant. The improved plant at Alfred, which was installed by private parties, was equipped with an automatic excavator, spreading machine, and a cable-way for transporting pulped peat from the machine to the drying field. The entire plant was operated by electricity generated in a power plant, situated a short distance from the bog, which used the broken and waste peat fuel. The practice of employing individual motors was followed whenever possible. The unfortunate conditions prevailing at the time this plant was ready for manufacturing peat fuel on a commercial basis, and which prevented its continuous operation during an entire season, did not permit an accurate estimate of the manufacturing costs to be made. It has been stated, however, that these were much lower than those obtained with the Government plant.

**Location of  
Plants**

Great care must be taken in the selection of a bog in regard to ease of drainage, suitability of the peat content for the manufacture of fuel, and its situation with respect to railway or other transportation facilities and contiguous towns or villages. The large volume occupied by peat as compared with coal does not permit of its transportation over long distances. It is, therefore, vital to the success of a peat industry that the peat plants be situated as close as possible to the community or communities they are intended to serve. Fortunately, most of the peat bogs so far examined are admirably situated with respect to both transportation facilities and proximity to cities, towns, and villages, and are, in other ways, suitable to the manufacture of peat fuel.

**Gas and  
Electricity**

Certain of the bogs conveniently situated with respect to industrial centres, which have been shown to be of large extent of high nitrogen content, should be utilized in by-product-recovery-producers for the generation of an industrial and power gas. Electrical energy could be economically generated at the bog and transmitted to the industrial centres, or a power and industrial gas could be transmitted through mains to the same centres for various uses. This latter method of employing power gas generated by a by-product-recovery producer is made use of in the Staffordshire district, England.

**Sulphate of Ammonia**

By-product-recovery-producer-gas plants designed for the burning of peat fuel are in successful operation in Italy. At one plant, the peat is burned solely for the recovery of the nitrogen. In Canada, in the settled districts, there are peat bogs of very large extent eminently suitable for development, in which the nitrogen content is much higher than it is in any of the Italian peat bogs which have come under our observation. It appears, therefore, that the manufacture of sulphate of ammonia could be most profitably conducted at certain of our bogs which are known to be exceptionally rich in nitrogen.

The utilization of peat for the generation of steam will prove economic only when the price of coal is very high, or at such places where coal is difficult to get. Speaking generally, it is safe to say that peat fuel for steam raising cannot compete with good steam coal costing \$5.00 or less a ton. But, as the price of coal increases, as has been the case in the immediate past, and as it is likely to do at a more rapid rate in succeeding years, peat fuel for steam generation, wherever large deposits of peat suitable for fuel purposes are available, will become a very serious competitor of coal.

#### QUALIFICATIONS REQUIRED IN PRODUCTION OF PEAT FUEL

Now that renewed interest is manifested in the exploitation of peat bogs for the manufacture of fuel, as is evidenced by the increased number of applications which come to the Mines Branch for its literature on peat, from England, Ireland, Russia, France, the United States, and our own country, it is imperative that we insist that those who intend to engage in the active operation of the manufacture of peat fuel should possess certain qualifications for this class of work, to avoid a repetition of the failure and loss of capital which have characterized the history of attempts made in the past.

These qualifications are:

- (1) Possession of the experimental facts relating to the physical and chemical properties of peat.
- (2) Knowledge of the investigations which have been made by specially trained engineers in the peat-producing countries of Europe in the exploitation of peat bogs for the production of fuel.
- (3) Possession of such knowledge of engineering and collateral sciences as will enable them to correctly design the machinery required for a successful peat plant.

**Specialists  
Essential**

In other words, the person entrusted with the designing and operating of a peat plant must be a peat engineer, a specialist, such as they turn out in the peat schools of Russia, Sweden, and other European peat fuel producing countries. No person should be employed who has not demonstrated, by previous work in the same line successfully accomplished, that he is the right man. This is a general principle, applicable to all technical work, and should, hereafter, be insisted upon throughout the country in the development of any industry. Any other course inevitably leads to failure and loss of capital, as has been abundantly proven by experience, extending over a period of nearly fifty years, in connection with the development of the peat industry.

Permit me to show by a few illustrations how failure might have been avoided in the establishment of this industry in Canada, if the persons engaging in this enterprise had possessed the knowledge and training we should insist upon.

**Value of  
Scientific  
Knowledge**

Nothing certainly seemed more simple and reasonable than to attempt to extract the 90 per cent water content of peat by pressure. The failure of the attempt was ascribed to the imperfection of the machinery employed. The solution of the problem, therefore, seemed to lie in the proper design and construction of the press. Much time and money were spent in the construction of presses which would accomplish the purpose, all of which might have been saved had it been understood that humified peat possesses the properties of colloids, resisting all attempts to remove the water by pressure.

It is quite evident also that the economic removal of water by artificial heat would be an immense achievement, since it would render the manufacture of peat fuel independent of weather conditions, and might be carried on all the year round. But the amount of heat required to extract the water content of raw peat has been calculated with mathematical exactitude, and the number of calories required is so great, that, to say nothing of the expense of the extra handling involved, this method is demonstrated to be impracticable.

Instead of rightly assigning the failure to the large quantity of heat required, it was charged to the improper construction of the dryers employed, and hence attention was directed to the improvement of the construction of dryers. It was not realized that a dryer with an efficiency of 100 per cent would not solve the problem, since, even with so perfect a dryer, the cost of the fuel required to

furnish the quantity of heat needed would render this method impracticable.

There is no question that peat fuel in the form of compact briquettes is more desirable than machine peat bricks or blocks, but after many trials and much experimentation the process of briquetting has not proven commercially successful, and briquetted peat fuel has not been and is not now on sale in the peat producing countries of Europe. And yet we still hear of schemes and processes, involving the impracticabilities described, being offered as solutions of the difficulties attending the successful production of peat fuel as a commercial enterprise.

**Credulous Business Men**      So rapidly has science advanced in recent years, and so startling have been the discoveries made, that what would, 50 years ago, have been regarded as almost a miracle is now passed over as something to be expected and not calculated to arouse wondering admiration. This frame of mind is responsible for the credulity of those not scientifically trained, and accounts for the fact that some of the shrewdest business men prove easy game to the enterprising promoter and pseudo-inventor of schemes and processes, incapable of commercial realization. No discovery has been made in any department of science which cancels in any particular the well-established laws of nature, and the scientist is, therefore, still able to say regarding a proposition of process, if it is contrary to laws well known to him, that it is economically impossible. Until the public cease to listen to schemes proposed by men who have neither the education, training and experience to arouse a legitimate faith in the soundness of the scheme offered, failure and waste of money must be expected.

In 1910, at the annual meeting of the American Peat Society at Ottawa, I made in my Presidential Address the following statement: "The endeavour to accomplish *economically* by artificial means and in a short time what has been accomplished by nature in exceedingly long periods of time, namely, the change of peat into a substance similar to coal, has so far apparently not been attended with success." This statement is still correct, as will appear from the following:

Some three years ago, just before the war, an agent representing a firm in Scotland, who were exploiting the wet-carbonizing process, appeared in my office, endeavouring to interest me in that process. He stated that he came to Canada, not so much for the purpose of selling the stock of the company, as to look up peat deposits in Canada and Newfoundland, which the company intended to buy for the purpose of introducing their process in these two

countries. He showed me a briquette of the fuel made from peat by the process owned by his company. The briquette had all the appearance and properties of a first-class coal. I have no doubt its heating value was very high.

I listened with great interest to his enthusiastic description of the process with which, by the way, I was entirely familiar. The process consisted in heating the raw peat as it came from the bog to a high temperature in iron tubes under pressure. This was done for the purpose of destroying the hydrocellulose and carbonizing the peat material in the hope of being able to extract the water content from this chemically changed material. But, unfortunately, the substance, when subjected to pressure, refused to part with the major quantity of the water content, and artificial drying and briquetting had to be resorted to, in order to produce the elegant briquette which I am passing around for your examination.

I looked over the cost-sheet he presented for my inspection. As a piece of book-keeping it was perfect, and the cost of the product per ton was ridiculously low. I forgot the exact figures.

I can just imagine a number of financiers and business men sitting around a table, each holding one of these briquettes, and listening to the oratory of the promoter of this famous process. "What ! produce from peat a coal cheaper almost than it can be mined, and in such elegant pieces ! Why, there is a fortune in it !" How often must these little briquettes have served the purpose of a talisman to empty the purses of the listeners to the eloquent promoter, for I understand that the company has already spent \$1,500,000, and the Swedish experts some \$40,000 additional.

I asked the agent how many thousand tons they were producing per annum, and at what price the product sold, and with child-like innocence he informed me that the company were not manufacturing for sale as yet, since there were a few changes which had yet to be made in the machinery. This was three years ago, and I presume they are still making changes in the machinery, and are simply turning out these beautiful little briquettes to aid them in selling stock. I instructed the Chief Engineer of the Fuel Testing Division, when he was in England investigating by-product gas producers, to go to Scotland and examine and investigate in detail the process I have described. But, although he made every effort and saw a number of the directors, he was not permitted to see the plant.

Back to  
Nature

Now, the process I recommend to be employed in the exploitation of our peat bogs does not attempt to produce a chemical change in the peat substance to turn out briquettes which in every respect have the properties of coal. The process I recommend takes the peat as nature has laid it down for our use, and utilizes for the extraction of the water content the forces of nature, sun and wind, which cost nothing. This is the process employed in the manufacture of peat fuel in all the peat-producing countries of Europe. Any improvement of this process will lie in the direction of labour-saving devices.

The promoter, as we know him, the pseudo-inventor, and the fakir, are passing away, for the British Empire and the United States have declared that hereafter science and scientific methods shall be applied to the affairs of nations, and councils and commissions of able, scientific men have been appointed in these countries, to advise the Government and their people regarding the subjects to be investigated, and recommend the men fitted by training, education and experience to undertake these investigations. The educative influence these councils and commissions can exercise upon the general mass of the people should be very great, rendering innocuous the present credulous frame of mind of the people, teaching them to look for sound opinions on industrial matters to those whose training and experience have rendered them competent to speak with authority. With this change in the mental attitude of the people we may look forward with hope to the establishment of a peat industry on a sound basis in Canada, and thus insure the people against a possible shortage of fuel and the suffering it would entail.

SIR CLIFFORD SIFTON: We are fortunate in having with us Mr. C. A. Magrath, the Fuel Controller of Canada. He is one of the very busiest men in Canada, and has not time to prepare papers, but has been good enough to say that he would speak to us for a few minutes in regard to the present fuel situation in Canada. I am sure that we will find what he has to say very interesting and instructive.

# The Fuel Situation in Canada

BY

C. A. MAGRATH

*Fuel Controller for Canada*

IT is a very desirable virtue to be agreeable, but it sometimes leads us into trouble. I feel that that is my position to-day. I was persuaded to come here by you, Mr. Chairman, but I think I made it absolutely clear to your Assistant, my friend Mr. White, that I would not undertake to discuss the fuel problem in Canada at the present time, at least not at any length. I have a very good reason for taking that position. In the first place, when I have anything of importance to say bearing upon the fuel problem of Canada and solutions of certain features of it, I think my views should be given first to the Government and that I should seek through it for the adoption of such regulations as will improve the situation.

There is another reason—a more important one—and that is, that, since my appointment as Fuel Controller, I have been travelling about the country to such an extent that I have not had time to sit down and carefully prepare anything that would be of real value to you at the present time.

There is still a third reason which weighs quite heavily with me: I can conceive of nothing more irritating to those who have an insufficient supply of fuel for their immediate needs than to hear of my getting up and talking about the fuel question instead of being out working for them, endeavouring to get them fuel. I take that side of the question very seriously, and it certainly has been engaging my entire time since my appointment last spring.

The Task  
Outlined

Baron Rhondda stated the other day that he had lost some twenty odd pounds in practising what he has been preaching. I do not know whether it has been practising what I have been preaching, but I can say that I have likewise lost considerable weight, at least in the earlier stages of my connection with this fuel question, for the simple reason that it seemed impossible to get a proper starting point. I knew I had something to do for the people of Canada, that the problem was, and is, to keep the houses of this country fairly comfortable—not

over-heated; to keep at least the essential industries of this country going, and to see that the people get their fuel and, especially the people of moderate means, without extortion.

Using Existing Channels      Fully 60 per cent of the fuel used in Canada is obtained from the United States. That condition is not due to the war. We have always gone to our neighbours for our fuel for central Canada, or, rather, our neighbours have persistently canvassed this country for fuel orders. We have had channels created for bringing that fuel into this country, and it seemed to me, when first taking up the work, that it was better to use the existing channels than to attempt to develop something of my own to meet the situation. To attempt to disturb long-standing trade channels, especially in connection with a product over which we have no control in the country of production, would be about as successful as my walking into a departmental store, driving everybody out and saying, "I am going to operate this institution on more efficient lines." For several months it would certainly be a case of a bull in a china shop. I had no time to waste in learning the coal business because winters come regularly and we have reason to know them when they get here. Therefore, I adopted the policy of using the existing channels, the dealers in coal, in Canada.

I have treated them as I believe them to be, on the whole, men of responsibility, men engaged in a legitimate business, and conducting their businesses as legitimately as those engaged in any of our other industries. I appreciate that that is not the view I have frequently heard throughout the country. There seems to have been an impression—an unfair one—that coal dealers, as a class, are worse than horse thieves. There are men in all walks of life who will take advantage of the other fellow if they get the opportunity, but such men are not to be found in the fuel business alone. One feature of my work is to get my hands on the coal extortionist. Should I find any, I can assure you that there will be 'something doing,' because I am not in this business for the fun of the thing. If I cannot prevent extortion, I will retire and let someone else have a trial at it.

Of course, I have been asked to do all kinds of things which I feel are not fair. I must be fair to everybody, fair to the dealer, fair to the producer, and fair to the consumer, and I say, with all sincerity, fair to the people of small means. I must see that they get their fuel in the most reasonable way. That is the position as I have placed it before the fuel dealers of this country. I have met them from one end of Canada to the other, and I have told them

that I would facilitate their work in every possible way in order to supply the country with fuel, and that I expected their loyal co-operation. I believe I am having that co-operation.

Now I will make a confession—a confession I was free to make, even when in politics, and, in that respect, I rather think I stood with a very small minority—I can make mistakes. As a rule men, especially in politics, never make mistakes. Well, I can make mistakes, and I have made mistakes—and I will make mistakes. Of course, since I have been engaged in this fuel work I have been told that I am of little or no account because I cannot land a car of coal for some particular locality. However, they have not yet convinced me that they are correct in their opinions of myself.

Railway  
Coal  
Operators

I should like to say a few words to you about the production of coal in the United States, whence we procure our supplies. There, many of the large coal mines are owned or controlled by certain railway companies. The policy of the railway company is to get profit out of the production and then to create traffic for its line by hauling the coal. We have, for instance, the Delaware and Hudson railroad running up towards Montreal supplying territory east of Ottawa to Quebec. Then there are the Delaware, Lackawanna and Western and the Lehigh Valley railroads, running towards Buffalo. They carry their coal largely towards the Niagara gateway. These and the other larger companies probably produce 80 per cent of the hard coal in the United States which will, roughly speaking, amount to a grand total this year of about 90,000,000 tons.

The  
'Independents'

The other class of mines, the smaller ones, called 'independents' each produce 300, 400 and 500 tons daily. Those mines have no railway connections and have no well-defined territory in which they market their coal. When this greatest of world crises arose, we found the larger companies struggling to continue their fixed policy of distributing their product along their railways, while the output of the 'independents' seemed to be scattered in all directions. The public were in a panicky condition, fearful that winter would find their bins without fuel, and it became practically a 'grab' game in gathering needed supplies. To accentuate this abnormal condition, the wheels of industry have been speeded up to a tremendous extent, especially in the United States, and the transportation system has become clogged. Then it was cleared, to be followed by further clogging of its wheels, with those in authority gradually making changes yielding better results. The difficulty is, I understand, not one of

insufficient number of railway lines, nor one of deficient equipment, but is mainly restricted terminal facilities.

Transportation Difficulties

The policy of the Car Service Section of the United States Railway Association for National Defence has been to use coal cars in the shortest possible hauls so as to make each one carry the maximum tonnage. Further, those dealers who have been dividing their orders—and they are frequently to be found in the smaller centres—have been receiving less attention on that account than those taking their entire supply from the larger shippers. And there are still other reasons. As a result, a number of localities, especially interior points, are insufficiently supplied at this time. The needs of those districts have been put forward time and again; the reply from the large companies has always been: "Wait until we move the coal that has to be delivered to water routes; let us get rid of that, and then we will devote our energies to meeting the needs of those places in Canada now needing fuel."

Small Places Suffer

I want to make that situation clear, because a misconception as to the reasons for the inability to get coal to these places has received general acceptance. You might think, for instance, that I could take the coal as it enters Canada and divert it to some other place than the point to which the mines shipped it. Now, I do not propose discussing that feature beyond saying that I could not do such a thing, or, perhaps it would be more correct to say, I have excellent reasons for not having attempted to do it. Of course, you can appreciate the natural desire of the large shippers to continue to deal through their regular agents. Those shippers recognize that this abnormal situation will pass away ere long, and then, when normal conditions return, they want to have their own agents continue looking after their own trade in their own way.

Unduly Favoured?

One difficulty that I have had to contend with is that the very atmosphere in the United States, especially in sections with insufficient fuel supply, has been reeking with the statement that Canada has been getting much more coal than she is entitled to. We have, it is true, been getting a fair supply; but our import figures and the export figures of the United States show a very wide divergence. For instance, in the matter of anthracite coal, the United States statistics of exports to Canada, April to August inclusive, this year, are 600,000 tons higher than our figures. Respecting soft coal, their export figures, for the same period, are 1,000,000 tons greater than ours.

If we had received the tonnage indicated by the United States statistics, we certainly would be very well off indeed, and those claims of excessive shipments to Canada are based upon these export figures. The situation became so acute that I was forced to bring it to the attention of our Customs Department, and one of its officers was sent to the United States. The result was the finding of considerable errors in their export figures of both anthracite and soft coal, justifying my adhering to our own import figures. In addition, it is usually considered that the statistics of the imports of any country are likely to be more reliable than its statistics of exports.

**Control of  
Prices**

The question that I have been confronted with, from time to time, in this country has been: Are you going to control prices? I always replied by saying that I proposed to do so. The only way that we can control prices, it seems to me, is to control profits, because the small 'independent' mines are allowed to charge more for their coal than the larger companies, with the result that there are variant costs for coal in the same locality. Consequently, regulations were passed by the Government on the first of December, 1917, under which we are issuing permits to all dealers and to all importers of coal. The object in adopting a permit system is to have control of those dealing in coal. Under those regulations, the Fuel Controller has the authority to either cancel or suspend permits for cause. We are issuing permits to the broker, that is, the dealer who sells coal to another dealer without physically handling it. The broker is allowed a charge not exceeding 30 cents per ton. We also issue permits to wholesale dealers, those who receive coal, for instance, by water, dump it into a yard, and ship it out to other dealers. The wholesale dealer is allowed to charge a figure not exceeding 35 cents a ton, plus reasonable overhead charges in connection with the handling of the coal. All importers of coal must obtain permits. Finally, we are limiting the dealers who sell to the consumers to a net profit of not more than 50 cents per ton, that is, in addition to overhead and delivery charges. These regulations, it seems to me, afford ample protection to the public against extortion, should any dealer be disposed to take advantage of the present abnormal situation.

**Fuel  
Conservation**

There is one feature of my work that must receive greater attention from this on, and in which I believe the Commission of Conservation can be of considerable assistance, and that is, in impressing on the public the necessity of conservation. With your permission I will read from

a small pamphlet now being issued by the Fuel Controller, a few paragraphs indicating the line along which your Commission can be of material service:

FUEL WASTE—The value of coal at this time cannot be measured in terms of mere money. Because a man is abundantly able to pay is no particular reason why he should expect to receive all the coal he wants, to be used according to his own fancy. Nevertheless, I firmly believe that this is the attitude of many. Perhaps it would be more charitable to say that they carelessly fail to give thought to their obligations to others less fortunately situated in regard to money. I would have thought that the existing prices of fuel would have been sufficient to induce all to conserve fuel, but my observations have quite convinced me that there is undoubtedly extravagance in fuel on the part of many in this country. *This waste must stop*, even if it is necessary to publish the names of 'first families' who transgress in this matter. Fuel waste at this time is nothing short of a crime. Canada must have fuel; our winters demand it; our industries depend on it. It is the life-blood of the nation. Therefore, let our slogan be: *Fuel saved is fuel made.*

SIFT THE ASHES—Every consumer of fuel for heating purposes who personally attends to his furnace should invariably sift the ashes. If hired help looks after it, he should personally see that such is done. The Fuel Controller's office knows the amount of imported coal that has been going into each city, town and village in Canada, and any evidence of increased demand will be rigorously looked into. The time may come when the Fuel Controller will be forced to apportion coal. Therefore, those communities which show evidence of thrift will receive more consideration than those which do not. Furthermore, it is the wish of Dr. H. A. Garfield, Fuel Administrator of the United States, that Canada should make its demands for coal as light as possible. Dr. Garfield has taken the position that he will treat this country on the same basis as a state of the Union. He has been exceedingly fair to us and it is my duty to see that we are fair to him, by exercising care and economy in the use of all fuel.

WOOD SUPPLY—In those localities where a certain amount of wood was used in normal times and the dealer or dealers have none, or an insufficient stock on hand, it seems to me the Mayor or Reeve should organize a small committee to take up the question of wood supplies. I am personally aware that there are men all over Canada not only willing but anxious to render public service at this time. Such committees should endeavour to organize gangs of wood choppers and get them out cutting wood so as to have available an emergency fuel supply. I am aware that large numbers of our axemen have gone abroad in forestry battalions. This action has naturally had the effect of reducing wood supplies; nevertheless, nothing should be left undone to secure stores of wood.

While I do not desire to unnecessarily alarm fuel consumers in Canada, it is a fact that we are at war and in such times it is impossible to say what may or may not happen at any moment. It must

be apparent to all that an emergency would quickly arise should any untoward event intervene, such as strikes or greater transportation difficulties than at present exist. Prudent communities will prepare for such eventualities.

**AN APPEAL TO PUBLIC SPIRIT**—Under the coal regulations now in effect, the Fuel Controller has power to requisition any coal in store beyond a two months' supply, whether it be in the cellar of a private house or in the possession of any industrial or other concern, the moment an emergency arises in any community. As has been stated, we have sufficient coal within the borders of Canada for all immediate requirements. When, therefore, owing to unequal distribution, an emergency arises, *those who have must sell part of their store to those who have not.* From the point of view of public interest this position is unassailable. Certain machinery must, of course, be set in motion to act under this regulation. This is vexatious and takes time. Indeed, it should be quite unnecessary. The moral obligation (apart from the legal obligation) rests on every citizen, who has a store of domestic coal in his possession, to see that no one in his community suffers from want. This is National Service. If he fails in this humane duty during the present world crisis, the Fuel Controller will undertake to set the law in motion and teach him a lesson in humanity. I firmly trust and believe that voluntary action will render superfluous any official steps on my part in this respect.

**DISTRIBUTION OF COAL**—Let me address a word to the coal dealers. I expect them, from now on, to so distribute coal as to meet the needs of the consumers, without my having to take any drastic action. I might especially caution them, where the coal supply is short, to give precedence to their deliveries to people who are unable to get wood. Farmers and others who have wood lots should only be supplied after more urgent cases have been satisfied. Lastly, if the regulations respecting the hoarding of coal are ignored in any way to the detriment of those who can only afford to purchase in small quantities, I shall not hesitate to take the most drastic and prompt action.

I think there is nothing further I care to say at present on the fuel situation. Anything that the Commission of Conservation can do towards making it clear to the public that the country is at war, and that we never know what may or may not happen to interfere with the supplies, will be of service. We positively must conserve fuel. Apart from the soundness of such a policy, let me add that, if we do not show evidence of it, it will adversely affect our supplies from the United States.

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# Forest Fire Protection in Ontario

BY

E. J. ZAVITZ

*Provincial Forester, Ontario*

THE Forest Fires Prevention Act passed by the Legislative Assembly of the province of Ontario in 1917 places the administration of forest fire protection under the Forestry Branch of the Department of Lands, Forests and Mines.

**New Legislation** Without going into the details of this new act, it is of interest to point out the new features which are added to the Ontario forest protection service.

Control of the setting out of fire within forest regions is given through regulations passed by order-in-council. It is necessary between the 15th of April and the 30th of September to obtain a written permit in order to set out fire for the disposal of slash or other debris. This written permit is issued by the fire ranger or other duly authorized official after personal inspection and contains certain restraining conditions. The ranger is given special instructions in reference to the conditions under which the permit is issued. For example, he may find it advisable to name the exact hour at which burning shall start or that some special protection be provided while burning is being done.

Another feature of the new act is the provision for the disposal of fire hazards. Wherever conditions exist which are a menace to life or property, the act provides for definite action by which such danger may be removed.

**Field Organization** The forest region of Ontario, subject to the Forest Fires Prevention Act, is divided into 35 districts, each of which is in charge of a chief fire ranger.

During the past season we have had 34 deputy chiefs assisting the chief fire rangers where areas were large or difficult of access. The maximum number of rangers for any one period of the past season was 1,039.

In addition to the above organization, we have had 12 railway inspectors, whose duties were to carry out the provisions of Order 107 of the Board of Railway Commissioners for Canada. For

inspection purposes, the forest region was divided into three inspec-toral divisions with a superintendent in charge of each division.

To sum up, during the past season the entire force required in the field, for the carrying on of this work, was 1,123 men. You will readily understand that with a territory so large, it will require time and experience to work out the most satisfactory field organization.

**Methods of Protection** Forest fire protection cannot rely alone on the ranger or patrol system. The 1,000 men in the field as rangers are helpless, if not backed up by modern detection methods.

During the past season, the look-out tower, on high points, has been introduced into nearly all the districts. This method had previously been adopted on the Nipigon reserve and found of great assistance in detecting fire. During the past season, 85 towers have been built at a cost of over \$10,000. These are permanent structures so located as to permit of communication by telephone with outside assistance. In addition to the permanent tower, rangers are instructed to clean out trails to high vantage points. These observation points frequently command a view over vast areas and are of great assistance in locating fire.

One of the most difficult problems in fire detection is to keep up lines of communication. The look-out tower without means of communication by wire is of small value. The look-out towers in Nipigon reserve are connected with a system of 130 miles of telephone line. We have, at present, about 200 miles of telephone line available in forest reserves. Throughout most of the settle-ments in the Clay Belt where towers have been built, local telephone lines are available. Along some of the railways, it will be possible to connect with the local stations.

The whole question of communication requires special attention, and we have not rushed into the construction of telephone lines on a large scale, feeling that more study should be given the problem.

**Reaching and Fighting Fires** Locating forest fires is a comparatively simple matter. Reaching them in time to take effective measures is the serious problem. In many of our districts, the only way of reaching interior fires is by long canoe routes and trails. However, in such districts, fire hazards are usually small, owing to the inaccessibility of the territory.

Where roads, navigable water or railways make rapid trans-portation possible there are various methods which help in solving

the problem. During the past season, we have employed three small power boats along the shores of Georgian bay. We have four larger power boats on lake of the Woods, Winnipeg river, lake Nipigon and lake Timagami. In addition to these, we have several outboard motors which are primarily intended to assist chiefs in covering territory where previously they had long canoe-trips on the larger waters.

The most efficient arrangement to be made with a power boat is such as we have on lake Nipigon. The boat remains the major portion of the time at a definite headquarters, which can be reached by telephone from the outlying stations and lookouts. It is equipped with a fire pump and 1,000 feet of 1½-inch hose, as well as other fire-fighting equipment and can proceed to a fire with the least possible delay. At present, we have three power boats equipped in this manner. On railway lines, we have five power motors used for inspection purposes and for carrying fire-fighting equipment. In patrolling railways, some 80 velocipedes, with such mechanical attachments as the Smith motor, are being used.

Last spring five motor-trucks were purchased and these are giving good results in the districts where roads are passable.

Our organization necessitates the use of about  
Equipment                    \$100,000 worth of equipment. In addition to  
                                    blankets, canvas buckets and minor equipment,  
it was necessary to purchase this season 185 canoes at a cost of  
\$10,000; 200 tents at a cost of \$3,000; and 28 new velocipedes at  
a cost of \$1,500.

The overhauling and repairing of equipment and its proper storage has required the building of five central store-houses, whilst several others have been leased temporarily.

Improvement Work           Improvement work, such as construction of trails,  
etc., can only be carried out efficiently after the  
field organization has been perfected. Our organization, being less than a year old, has much to learn, but the following are some of the most important improvements carried out during the past summer: new fire rangers' cabins built, 44; new docks or boat landings, 18; acres of fire hazard burned, 3,356; miles of old trails and canoe routes cleaned out, 1,031; miles of new trails opened, 514; and fire signs posted, 50,000.

Owing to a very wet season in the Timiskaming country, the permit system was not given a severe trial. Our rangers issued 3,886 permits and no serious opposition was encountered.

## FIRE STATISTICS FOR 1917

| NUMBER OF FIRES: |       | CAUSES:                 |       |
|------------------|-------|-------------------------|-------|
| May.....         | 441   | Settlers.....           | 91    |
| June.....        | 317   | Camp fires.....         | 98    |
| July.....        | 152   | Railways.....           | 541   |
| August.....      | 115   | Lightning.....          | 28    |
| September.....   | 66    | Indians.....            | 54    |
|                  |       | Logging operations..... | 45    |
|                  |       | Miscellaneous.....      | 40    |
|                  |       | Unknown.....            | 194   |
| Total.....       | 1,091 | Total.....              | 1,091 |

56.1 per cent did not damage more than 5 acres.

## AREAS BURNED:

|                                       |         |       |  |
|---------------------------------------|---------|-------|--|
| Timberland, mainly coniferous.....    | 71,910  | acres |  |
| " " hardwood.....                     | 110     | "     |  |
| Cut-over, some coniferous timber left | 148,368 | "     |  |
| " " hardwood                          | 2,160   | "     |  |
| Young growth, mainly coniferous...    | 60,625  | "     |  |
| " " hardwood ..                       | 13,202  | "     |  |
| Barren.....                           | 82,922  | "     |  |
| Grassland.....                        | 2,332   | "     |  |
| Total.....                            | 381,629 | "     |  |

| TIMBER ON BURNED AREAS: |            |
|-------------------------|------------|
| Ft., B.M.....           | 15,278,000 |
| Cords.....              | 90,446     |
| Ties.....               | 781,685    |
| Posts.....              | 150        |
| Poles.....              | 125        |

The most serious fires occurred in May and early June, running over large areas in the form of ground fires. No monetary value has been placed on the above estimates, as a considerable amount of injured pine will be salvaged. The most serious aspect of such fires is the injury to young growth and soil conditions.

The forest region of Ontario over which our organization has jurisdiction covers an area of over 100,000,000 acres. The greater part of this region is covered with coniferous growth. Large areas have been cut over, leaving inflammable slash. Three transcontinental railways, over one thousand miles in length, pass through the territory, opening it up to prospector, timber cruiser and settler, all of whom bring problems of fire protection in their wake. In all, over 4,000 miles of railways traverse this forest region.

## DISCUSSION

SIR CLIFFORD SIFTON: I am sure we have been very much interested in what we have heard from Mr. Zavitz. He was not here when I spoke this morning, and I want to repeat what I then said, that the province of Ontario, whose forest service lagged behind for a long time, is to be commended for the reorganization it has effected and for establishing an active and vigorous fire protection service. I think Hon. Mr. Ferguson, the Minister of Lands, Forests and Mines, is primarily entitled to credit for having successfully

urged this step upon his colleagues and having secured the adoption of the system Mr. Zavitz has described to us.

**Patronage**                   Mr. Zavitz and everybody who has had anything  
**Kills**                           to do with Government service, knows that the  
**Efficiency**                   efficiency with which this organization works  
depends upon the men employed. If he and Mr. Grigg, the Deputy  
Minister, can have a free hand to employ the right kind of men as  
rangers and assistant rangers, they can soon develop efficiency;  
but, if they are hampered by the methods by which officials frequently  
are in matters of that kind, they will have serious difficulty  
in making their service efficient.

The complete adoption of the merit system in making appointments and promotions in the field force will depend largely upon the Deputy Minister and the Provincial Forester. They will likely have to do some fighting for it, and I want to say to Mr. Zavitz, and through him to Mr. Grigg, that in carrying on that fight they have the sympathy and support of educated scientific opinion all over Canada and, in fact, all over America. We sincerely hope they will make the fight and succeed, so that the fire protection service of Ontario will be what it ought to be—a model for all Canada and all the rest of this continent.

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BALSAM REPRODUCTION IN AN OPENING MADE BY A CUTTING 16 YEARS AGO.



BALSAM REPRODUCTION IN AN OPENING MADE BY A CUTTING 10 YEARS AGO.

# Forest Regeneration on Certain Cut-over Pulpwood Lands in Quebec

BY

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BEFORE describing certain investigations on cut-over pulpwood lands in Quebec, I desire to make a few remarks upon the general situation. The necessities of war are driving home to us the importance in our national economy of natural resources, among which our timber resources take a leading place. There never was, and, for years, never will be, a time when it is more important for us to know what our timber resources really are, not only in terms of board feet and cords, but also in terms of their application to new uses.

For thirty years, in meetings similar to this, we have been discussing the management of our timber resources, but what have we accomplished? Of many facts, fundamental in the efficient management of the timber resources of the country, we are woefully ignorant. For example, what do we really know about the extent of the timber and pulpwood resources of Ontario and Quebec, though these provinces, combined, contain the largest timber-producing area in Eastern Canada? Where else is there such a large timbered area, containing so many valuable species, with such wonderful transportation facilities, both natural and artificial, and so near, relatively, to the great markets of the world?

This great timber-producing area has been right in our back yard all these years. It now has along its borders a population of 5,000,000, whose consumption of wood products is increasing every day; and just over the fence are the populous Eastern States, with their urgent demands for Canadian wood products. In the face of constantly widening markets and increasing demands, have we really made any methodical, sustained effort to determine the possibilities and the potentialities of the timber resources of Ontario and Quebec? Do we know whether this area can meet the demands now being made upon it, to say nothing of the much greater demands in the future? The United States is thoroughly alarmed over its declining pulpwood supply; we are so ignorant of ours that we do

not know whether to be alarmed or not. Is that an enviable situation for an intelligent and progressive people?

### THE PROBLEM ANALYZED

**Survey of  
Pulpwood  
Resources**

There are at least three definite lines of enquiry to be pursued in connection with the problem of our pulpwood supply. In the first place, there should be a definite stock-taking of the commercial material now available. We must know what we have before we can make any sensible plans for the future. Not every acre, nor even extensive areas, should be actually cruised, for the results would not justify the expense; but sufficient cruising should be done and enough data gathered to permit of reliable estimates being made. Such work has already been done by the Commission of Conservation in British Columbia, and it is under contemplation for Ontario.

Estimates of the available commercial pulpwood supplies in the province of Quebec have been made, but, as yet, there has been only a partial methodical stock-taking, despite the fact that Quebec is the most important pulpwood area in Canada, supplying over one-half of the pulpwood produced in the Dominion. Nearly half of the pulp mills in Canada are situated in Quebec. With her long southward-flowing rivers, extending into the very heart of the pulpwood regions, with her water and rail connections, Quebec is much nearer the ultimate market for most pulpwood products than any other province with an equal supply of material. Indeed, this very accessibility increases the danger of early exhaustion of her supply. Logically and economically, Quebec should be the first to institute a thorough-going investigation of her present supply of pulpwood.

**Rate of  
Growth**

Once we have taken the initial step of ascertaining how much pulpwood we have in Eastern Canada, its distribution and its accessibility, we can, with a known rate of consumption, make a reasonable prediction as to the duration of the supply. Since, however, we are dealing with living wood substance, which has the wonderful power of regenerating itself each year, we must take another factor into consideration, namely, the rate of growth or, in other words, the annual accumulation of new wood fibre in our spruce and balsam forests. This brings us to our second line of enquiry, viz., a detailed study of growth and production, involving the making of stem analyses on carefully selected areas. To be sure, this is little less than drudgery; it is tedious, heart-breaking work, especially if done in 'fly' time; but it is only this kind of investigation that can furnish data by

which a ratio between the annual accumulation of wood fibre and the amount annually removed by the pulpwood operations, can be established. This ratio is essential to a reasonably accurate prediction of the duration of the pulpwood supply.

**Reproduction  
of Pulpwood  
Species**

The replacement of the pulpwood removed by any agency is brought about in the first instance by the growth of the small non-commercial trees already on the area. These, in turn, become of commercial size, they are eventually cut, and their place must be supplied by new individuals. New spruce and balsam must establish themselves in the forest if the supply of pulpwood is to be continued beyond one generation of trees. Therefore, the third line of enquiry to follow in order to solve our problem, is the rate of reproduction of the pulpwood species on the cut-over pulpwood lands. If the logging operations, or the fires which often follow them, change conditions to such an extent that spruce and balsam cannot maintain themselves in their former commercial quantities, the supply of pulpwood on those areas cannot be maintained.

#### GROWTH AND REPRODUCTION IN ST. MAURICE VALLEY

Investigations to determine the rate of replacement of pulpwood material by growth and by reproduction on cut-over lands, were carried out by the Commission last summer. Through the generous co-operation of the Laurentide Company and its forester, Mr. Ellwood Wilson, the work was carried on in the holdings of this company in the lower portion of the St. Maurice valley in Quebec.

**Balsam  
Predominant**

The forest here contains patches of pure hardwoods and patches of pure conifers, but mostly they occur in mixed stands. Numerically, balsam leads in the mixture, with 36 per cent, yellow birch comes next with 26 per cent, and spruce, which, by the way, is practically all red spruce and not the same as the black spruce, as is generally supposed, makes up 20 per cent of the forest. The minor species are cedar, 7.3 per cent; sugar maple, 5 per cent; paper birch, 3 per cent; hemlock, 1.4 per cent; and beech, 1.3 per cent. This type of forest occupies between two-thirds and three-fourths of the region studied. The old burns and the swamps were neglected.

It must be borne in mind that the results and conclusions herein stated refer only to this particular forest type and are in no way to be construed as applying to other portions of the St. Maurice valley, or of Quebec.

**Survey by  
Strip Method**

As already stated, the chief object of the investigation was to determine the condition of these cut-over lands with respect to the degree of regeneration and the rate of growth of the present pulpwood-producing species, namely, spruce and balsam. Sample plots were made by the strip method. These strips, run on a compass line, were one-half chain wide and varied in length from 1 to 80 chains. All the trees on the strips above 8 inches in diameter were calipered. Those from 8 to 4 inches in diameter were classed as poles, while those 4 inches in diameter down to trees breast high, were designated as saplings. At the end of every second chain, a square rod plot was marked out and the number of seedlings on it counted, any tree less than breast high being considered a seedling without regard to its actual age. The number of seedlings per acre was calculated on the basis of these square rod plots. The ages of the seedlings in relation to the time of the cuttings were also determined. The stumps on the strips were also calipered and the age of the cutting determined. The total area of the sample strips on which the trees of all sizes were thus measured, counted, and classified, comprises 60 acres.

The growth studies were made for the most part on four sample plots varying from 1/10 to 1 acre in size. Every coniferous tree larger than a seedling on these plots was cut and a complete stem analysis made of it. In this manner, the rate of growth of some 2,000 trees was determined.

**The Forest  
Primeval**

The original forest in the southern portion of the St. Maurice valley was undoubtedly dominated by pine, probably, for the most part, white pine. We found, on the average, 6 pine stumps to the acre still standing. This is the average of all the sample plots taken in all the various conditions. Only 8 of the sample plots failed to reveal at least one pine stump, and on some, the pine stumps ran as high as 20 per acre. Considering that the first cutting of pine in this region took place between 60 and 70 years ago, and that there has been practically no cutting of it for 30 years, thus allowing 30 to 70 years for the stumps to decay, it is quite remarkable that the average of all conditions should yield 6 stumps to the acre still recognizable as pine. Undoubtedly, we are safe in assuming that the original number of pine trees was considerably more than 5 per acre.

**Formerly a  
Black Forest**

However, I do not think of the original forest as having been a pure stand of pine. Although pine was biologically dominant, it was outnumbered by other species. I picture the original forest as having a distinctly two-storeyed crown cover. The lower storey was a mixed forest of

yellow birch, maple, spruce, and balsam, in abundance in the order named. Towering 50 or 75 feet above this were scattered giant pine trees from 3 to 6 feet in diameter, from 100 to 150 feet high, and probably 200 to 300 years old. Had there been only six such trees to the acre, they would have dominated it, but there were probably more, but not sufficient, however, to form a complete crown cover in this upper storey, except on rocky ridges. In the latter situations we often found from 20 to 30 big pine stumps to the acre, evidently indicating a pure stand. To one flying over the region at that time in an airplane, it would have appeared as a 'black' forest, that is, one in which the pines predominated over the hardwoods.

Passing  
of the  
White Pine

To-day the conditions are reversed; it is a 'green' forest, that is, one in which the hardwoods predominate. This change of conditions in the past 50 to 70 years is very interesting biologically, but it also has an important commercial significance. Those areas which have yielded enormous quantities of white pine are, commercially speaking, denuded of that species to-day; only scattered groves on rocky, inaccessible ridges and elsewhere an occasional tree towering above the hardwood forest, remain. Not only this, but of still greater significance to the future, white pine is not reproducing itself; there are practically no young trees in the forest. Except on the borders of lakes, the margins of swamps, and around old camp clearings, we did not see, under the normal forest cover in our investigations last summer, two dozen young pine trees. Yet we found old pine stumps everywhere. I can show you areas which once had 20 pine trees to the acre, but are without even a young pine tree to-day. Moreover, there are no coniferous trees in the crown cover—only a solid mass of yellow birch and hard maple.

Why a Green  
Forest Now?

There are, however, abundant balsam and spruce beneath this crown cover ready to push through whenever opportunity offers. Note especially that the areas of which I am speaking have never been seriously devastated by fire, the chief cause of the failure of white pine reproduction in Canada. Why, then, have these areas changed within the life time of some of my audience, from a dominant pine to a dominant hardwood forest? Why did the pine not reproduce itself after logging and so maintain itself in the forest? The hardwoods were probably originally more or less suppressed by the pines, both by shading and root competition. The removal of the pine stimulated the development of the hardwoods so that they soon filled up the gaps. The crown cover below the pine was probably continuous and cast a deep shade. The luxuriant underbrush formed another

shade-producing layer. These two layers excluded so much light that the young pine trees could not develop. The seeds doubtless germinated and the seedlings may have persisted for some years, but not receiving sufficient overhead light, they were eventually crowded out by the shade-enduring hardwoods.

**Over 100 Years for Spruce to Grow** These some-time white pine areas were subsequently cut over for spruce saw logs or pulpwood at least twice and some of them three times. Our growth studies show that all the spruce trees since removed by lumbering operations were present in the original forest beneath the pine trees. They were at least 6 inches in diameter and about 100 years old when the pine was cut. Many lumbermen think that the second cutting on an area is from young trees which have grown since the last cutting. The area which we are describing has been cut two or three times in the last 30 years and the youngest spruce cut was over 100 years old, most of the trees being more than 150 years old. This is the length of time that it takes to make a spruce forest from seed to pulpwood size, when the spruce grows up in company with hardwoods.

**Seventy Years for Balsam** The situation is somewhat different, however, in the case of balsam. Some of these trees now being cut for pulpwood were seedlings scattered on the floor of the original forest at the time the pine was first cut, that is, 70 years ago.

We counted and measured the stumps on all our sample plots. The spruce stumps averaged 22 per acre. At the present time, there are 6 spruce trees per acre entering the crown cover and over 70 years old. Therefore, at the time of the first cutting 70 years ago, there were 28 spruce trees 8 inches or more in diameter on the average acre. It is interesting to note in this connection, that according to Mr. Ellwood Wilson, forester to the Laurentide Company, there are 26 spruce trees 8 inches and upward in diameter in the virgin forests farther northward in the St. Maurice valley. This result is derived from cruising surveys, totalling over 1,000 acres and representing about 3 per cent of the area through which the strips were run.

Thus, you see that the number of spruce trees has been reduced from 28 per acre to 6, a reduction of nearly 80 per cent, by the lumbering operations of the past 30 years, the period during which spruce has been cut for saw logs. Our results show practically the same number of balsam as spruce trees taken from the average acre, namely 22, and the number of balsam larger than 8 inches in the present forest is also practically the same—6 per acre.

**Black to Green  
in 30 Years**

Let us go back and look a minute at the original forest, a pine forest with a mixed spruce-balsam-hardwood under-storey, giving the general impression of a 'black' forest. The pine was cut and did not re-establish itself; 80 per cent of the spruce and perhaps the same amount of balsam was cut. The result: within 30 years a 'black' forest was changed to a 'green' forest; it was changed from a softwood forest, to a hardwood forest.

**Its Economic  
Significance**

Very interesting, you say, but what of its economic importance? It is this: the pine and spruce and balsam are valuable, but the hardwoods, the beech, birch, and maple are, so far as we know, valueless, being too far from markets to be utilized at the present prices. Let me state the case from another standpoint. The sum of the basal areas of the spruce *stumps* of the various diameters on the average acre is 25 square feet. The basal area of the spruce remaining on the average acre is only 5 square feet. The volumes of trees are proportional to their basal areas. This means that the capital stock and, therefore, the earning capacity of those areas are only one-fifth of what they were originally.

**Young  
Growth**

There is, however, at least one other point which we should investigate carefully before we become too pessimistic in regard to the future of these cut-over lands. I refer to the young growth, the spruce and balsam trees not yet of commercial size. Are they in sufficient abundance to insure another crop? If so, when can we expect that crop? As already stated, these are the two principal questions we had constantly before us in our work last summer.

Here is the answer to the first question:

| Species      | Seedlings<br>(trees up<br>to 1-in.<br>diameter) | Saplings<br>(1-in. to<br>4-in.<br>diameter) | Poles<br>(4-in. to<br>8-in.<br>diameter) | 8-in. to<br>12-in.<br>diameter | Total | Per<br>cent |
|--------------|---|---|--|--------------------------------|-------|-------------|
| Spruce.....  | 635   | 99  | 30                                       | 6                              | 770   | 14.8        |
| Balsam.....  | 3972  | 161   | 59                                       | 6                              | 4198  | 80.8        |
| Cedar.....   | 180   | 32  | 8  | ..                             | ..    | 4.2         |
| Hemlock..... | 8   | 2   | 1  | ..                             | 11    | 0.2         |

**Mortality  
Rate**

At first glance, this looks very bright for the future, but let me refer once more to the mortality rate.

There are 635 spruce seedlings per acre, but when they get up <sup>near</sup> commercial size, they are all dead but 6. The

percentage of loss is still greater in the case of the balsam. In the beginning, there are 6 times as many balsam as spruce, but when the balsam gets into its commercial class of 7 inches diameter, there are only about twice as many.

You may say that the conditions have changed since the '8-in. to 12-in.' trees came through the forest cover and a larger percentage of the smaller-diameter classes will survive. You may be right. Conditions certainly have changed, but my impression is that, from the standpoint of the spruce at least, and perhaps also for the balsam, they have changed for the worse. Each logging operation has stimulated the growth of the hardwoods more than that of the softwoods. The crowns of the large trees soon fill in the gaps and a dense thicket of hardwood shrubbery is developed on the forest floor, thus producing more shade and suppressing the spruce and balsam still more.

**Outlook for Spruce**      Turning now to the '4-in. to 8-in. diameter' class, we find 30 spruce and 59 balsam on the average acre.

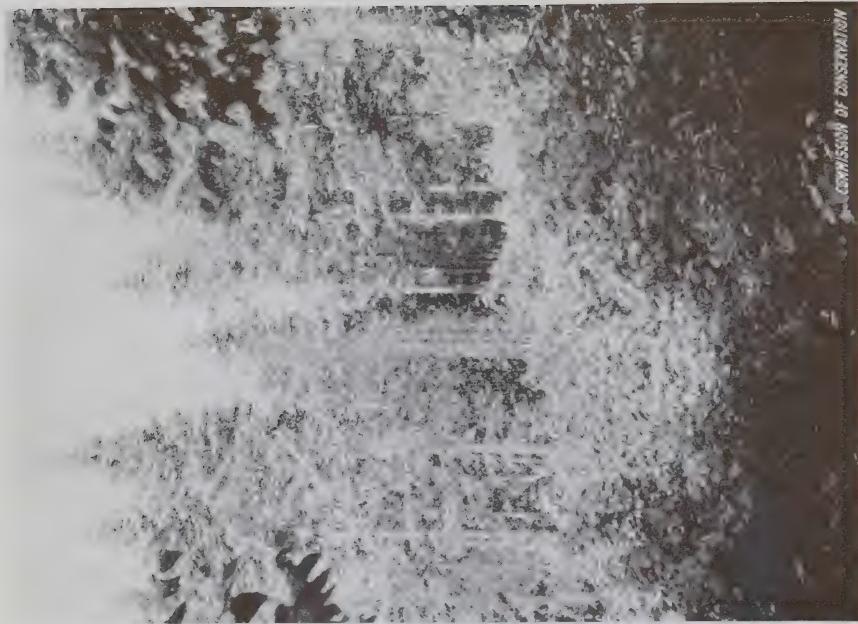
Twenty of the spruce and 40 of the balsam are dominant and they stand a good chance of persisting. If they should all enter the commercial class, they would furnish a sufficient future supply *in time*. 'In time'—that is the second phase of our investigation. When can we expect another crop? Our growth studies showed that the spruce trees in the '4-in. to 8-in. diameter' class were from 80 to 100 years old, and those of the '8-in. to 12-in.' class were from 100 to 150 years old. Therefore, it would take at least 50 years for the upper range (8 inches) and 70 years for the lower range of the class (4 inches) to reach the 12-in. minimum diameter limit for spruce in Quebec. I think you will agree with me that 50 years is too long for any private concern to wait for another crop of spruce on these cut-over pulpwood areas.

**Outlook for Balsam**      The present increased demand for woodpulp has led to a rapid increase in the proportion of balsam used.

So, if our 40 dominant balsam between 4-in. and 8-in. on the average acre reach commercial size, they would represent a valuable asset. In fact, some in this class are already commercial, for the minimum diameter limit for balsam in Quebec is 7 inches, but, unfortunately, the number of this diameter cannot be segregated from the '4-in. to 8-in.' class. However, according to our growth tables, it takes only about 10 years on the average for a balsam to pass from a 4-in. tree to a 7-in. tree; so, within that time there will be another crop of balsam on these areas.

Several factors, however, greatly reduce the value of balsam. As is well known, it is much subject to disease and windfall. Mr.





A DENSE THICKET OF MOUNTAIN MAPLE IN A RECENT CUTTING  
ON A CONIFEROUS SLOPE.



SUPPRESSED SPRUCE RELEASED FROM AN OVERSHADING  
CROWN COVER BY A RECENT CUTTING.

ONTARIO COMMISSION OF CONSERVATION

ONTARIO COMMISSION OF CONSERVATION

Wilson finds that, on the average, 44 per cent has butt rot. In certain conditions, we found as many dead trees as living. One rarely sees a balsam tree 14-in. in diameter and the great majority never get beyond 9-in. before death overtakes them. Such small trees scattered through a mixed stand may raise the logging cost to a prohibitive point.

#### MEASURES FOR REFORESTATION—HARDWOODS *vs.* SOFTWOODS

We come now to a consideration of what is to be done with these cut-over pulpwood lands. They belong to a provincial government and are leased by private corporations, chiefly by companies manufacturing paper pulp. They should, therefore, be considered from the standpoint of both these interests.

##### The Individual's Viewpoint

First, let us look at the matter from the standpoint of the private company. So far as another crop of spruce on these lands is concerned, the case is hopeless. No private concern could afford to wait 50 years, paying annual rental for that length of time for the sake of a few cords of pulpwood, probably less than three, per acre. The amount of balsam obtainable in the near future is problematical until we have had an investigation of the rate at which the everywhere prevalent heart rot is progressing.

##### Utilizing the Hardwoods

If the hardwoods could be utilized without too much destruction of the young spruce, the problem might solve itself. At present, the market for them is so far distant and the difficulty of transportation is so great that they are apparently valueless. However, some investigations of possibly great significance are about to be instituted by the forester to the Laurentide Company. Trials are to be made of the applicability of paper birch for pulpwood. There are enormous quantities of this in Quebec, impeding the growth of the spruce and balsam by its shade. It may be possible to establish a rotation between the softwoods and hardwoods and so keep the land continuously productive.

##### Birch for Railway Ties

The possibility of the use of yellow birch for railway ties is to be investigated. There is no doubt of the market for this purpose. The question is whether they can be profitably handled at present prices. If it proves profitable, the over-topping birch would be removed and a much larger portion of the 700 young spruce trees to the acre might develop into pulpwood.

If these possibilities become actualities, then the private concerns will not be compelled to surrender their leases.

The  
Government  
Viewpoint

Since these lands are to be held in perpetuity, it may be that their productive capacity in terms of spruce could be increased by raising the diameter limit, say to 14 inches. A conclusive determination of this point would involve a careful study of the comparative rate of growth of the trees 12 and 13 inches in diameter, and whether the increased growth, if present, or the increased stumpage value, would outrun the compound interest charges on the extra capital invested in the 12-inch and 13-inch tree. Since, however, at the present time, one finds only one 12-inch spruce tree on 5 acres and one 13-inch tree on 10 acres, and since, according to our growth studies, it will be 100 years before the 30 trees per acre in the 4-inch to 8-inch class will get into the 14-inch class, I have not made the computations necessary for the discussion of the benefit of raising the diameter limit.

There is, however, another consideration that seems to me important in determining the future of the lands from the government's standpoint. The hardwoods are at present biologically dominant on these areas. It may be that this is what nature intends, and that we have too great a handicap to overcome in trying to put the spruce back by natural means. Certain investigations to which I will refer later, may throw light on this point. If nature is really against us, it might be the best thing to cut every acre off clean, if a market could be found for the hardwoods, and start the spruce anew by planting. An experimental plot of this kind, of 60 acres, has already been inaugurated by the forester to the Laurentide Company, and its development should be watched with much interest. It may be that, even here, the biological conditions will prove the more favourable to the hardwoods and keep the spruce always in a subordinate position.

Lack of  
Accurate  
Knowledge

We talk easily of what we should do with a forest. In this particular case we want to increase the production of spruce, the most valuable species at present on this cut-over land, or at least, we would like to restore it to its former position in the forest. How can this be done? One man says: "Cut heavier, open up the crown cover, let in the light." Another man says: "Make a lighter cut, disturb natural conditions as little as possible." The result cannot be obtained by methods so directly opposed. What is the answer? The answer is that neither man really knows what he is talking about. Your opinion may be just as good as mine, because both have been spun out beneath our hats, or evolved from smoke rings, as we sat in our office chairs. We have no accurate knowledge, no definite records, no actual

measurements by instruments of precision, of the conditions as they really exist in Canadian forests. I repeat what I said in the beginning. We have been discussing the management of our timber resources for 30 years, but, as yet, we have not the fundamental knowledge of conditions on which it is necessary to base our plans, if we were asked to-day to put them into operation. What definite knowledge we do have as to conditions in which trees grow is borrowed from other countries, even European countries, whose conditions are not our conditions. Is it any wonder that we are groping in the dark? And we will continue to grope in the dark with this matter until we obtain actual experimental records of those environmental conditions that fashion a forest.

**Experimental  
Procedure**

Let me illustrate what I mean by using the Quebec cut-over pulpwood lands as an example. Here we have over 700 young spruce trees to the acre growing beneath a birch-maple forest. Normally, only one per cent of them lives long enough to make a commercial tree. The problem is to determine whether opening up the overshading crown cover to various degrees would bring a larger number of these suppressed spruces to maturity and thus increase the value of the land to the owner. To solve the problem, in certain plots, a light cull, a medium cull, a heavy cull, and a clear cut of the over-topping hardwoods should be made; and then, a definite record of results kept during a series of years. The intensity of the light exposure on each plot should be measured periodically; the rate of the filling up of gaps by the side growth of the tree crowns should be measured; the behaviour of the shrubby layer should be noted; any changes in the humus content or in other soil conditions should be studied; the height growth and the diameter growth of the little spruces should be measured periodically, at least every fifth year. The trees that show stimulated growth should be studied very carefully in respect to their root development, the moisture condition of the soil in which they are growing, the relative number and the size and vigour of their leaves.

**Inherent  
Dominants**

The necessity of studying the *successful* trees is emphasized because they may be the key to the whole situation. In a nursery bed, certain seedlings are more vigorous than the majority, making three or four times as much growth in a season as their companions. Now, it may be that they are inherent dominants, and once dominant, always dominant. We know there are inherent dominants among animals, including man. Why not among trees? If this be the case, why waste time and money planting any trees but dominants. It may

be that those which survive in the struggle for existence in the forest are those which are predestined to survive from the beginning. The truth or falsity of this suggestion is capable of being demonstrated by field experimentation and, logically, is the first prob'lem to be solved, for, if true, it would automatically solve many other problems as well and render further experimentation along certain lines unnecessary.

**To Determine  
Effect of  
Light** One more illustration of the necessity of field experimentation. Why is the young balsam so abundant and so aggressive in the logged-over forests; why is it more successful than the spruce, its principal competitor? Unless checked by its greater susceptibility to disease, balsam may, in time, dominate all our northern forests—no longer pine forests, no longer spruce forests, but balsam forests. Why the dominance of balsam reproduction? One man says it is because the balsam can endure more shade than the spruce, and another says the spruce can endure shading better than the balsam. One man makes the first statement in one of his papers, and the last one in another; and one of our best authorities makes the two contradictory statements between the covers of one book. Personally, I think the importance of light as a determining factor in the forest has been very much over-estimated by foresters. We have accepted it as a kind of tradition from our fathers, as we accept other traditions, without thinking very much about it and, still less, subjecting it to experimental proof.

Experimental plots should be established in the forest where the balsam and spruce seedlings are growing naturally and the light intensities should be measured in the two cases. Not only this, but other points need investigation, such as the comparative vigour of the roots of the two seedlings, their ability to penetrate the leaf litter in order to reach the mineral soil; their relative ability to endure drought; the rate and abundance of root growth in the two cases. With data of this kind, the result of measured records of environmental conditions, we could determine the reasons why certain methods of lumbering encourage the growth of balsam and discourage the growth of spruce. With such data, we could discuss with intelligence the means by which to increase the production of spruce pulpwood in Quebec.

To improve upon nature, we must first know how nature acts and reacts upon the thing we wish to improve. This is so self-evident as to be axiomatic, but, thus far, we have made no determined and sustained effort to get such data in regard to the forest. This has been the basis of plant and animal breeding and it must

be made the basis of forest breeding. We must not be deterred because trees grow more slowly than other plants and, definite results are, therefore, slower of attainment. It will require patience, perseverance, and time, but when it is done, we will have reliable data on which to base our plans and will be in a position to manage our timber lands intelligently. We could substitute a *real* policy for the trust-to-luck-and-nature policy of the past, in which both luck and nature have been against us, and which has already reduced a large portion of our incomparable forest heritage to the condition of waste lands.

#### DISCUSSION

SIR CLIFFORD SIFTON: Some of our members may desire to say a few words in connection with this very important address which Dr. Howe has given us. There are a number of gentlemen here who are very well qualified to discuss the subject.

Last summer Dr. Howe's activities were confined to cut-over pulpwood lands in the St. Maurice valley, Quebec. We desire to acknowledge thankfully the co-operation and assistance that was given to him by the Laurentide Company in connection with his work. The Laurentide Company has shown a very laudable desire to assist, and Dr. Howe is indebted to them for a considerable amount of help.

MR. SNOWBALL: Many of the points Dr. Howe has made have been brought to my own attention by our own forester within the past year. I am interested especially in the growth studies and was hopeful that Dr. Howe would suggest some method of overcoming the growth of the hardwoods. One section of the lands that my forester went over this past year has a very heavy growth of beech, and he has asked me how we might use these hardwoods. Many of them are large enough to use now and are very materially affecting the growth of the spruce. Last season, part of his work has been on cut-over pine lands and he found exactly the conditions Dr. Howe has described. From these lands we were not getting pine, but spruce, a great deal of white birch and what we, in our country, call 'bar'.

Less Growth  
Than Expected

I, in common with a great many other lumbermen, had a very erroneous idea of the rate of growth of our timber. Perhaps we did not want to think otherwise; we wanted the logs for our mills, and we wished to delude ourselves with the belief that our timber limits were growing at the rate of three per cent annually. But we are being wakened up by Government experts, as well as by other foresters, to the fact

that the growth is very much below three per cent. In the territory that we have gone over, I would be afraid to say just how much we fall short of three per cent; we are so far below it, it is really alarming. I cannot say how long we can continue operating in New Brunswick to the extent we have been, and extending the size of our mills with the deluded idea that we have a much larger quantity of lumber to draw from than is really in existence. I am satisfied that in New Brunswick we have not fully appreciated the importance of having a thorough investigation of our Crown timber lands made.

During the past season, the Provincial Government, acting in conjunction with the forester of our company, has been surveying the Crown lands of New Brunswick and I think there will be an awakening very soon to the fact that we shall have to use much more vigorous conservation methods in cutting pulpwood on Crown lands. This is going to affect all of us who have large mill capacity. We shall have to use some of the timber we formerly left in the woods, and, even with the present increased value of pulp, it is a question how long we can bear the expense of utilizing the smaller logs from the most distant limits.

I am very much interested in the maintenance of our forests. I want to hand them down to posterity so that they will be an asset to the province, and a continuing asset to the firm of which I am a member.

SIR CLIFFORD SIFTON: We have with us Mr. Ellwood Wilson, Chief Forester of the Laurentide Company, which has co-operated with Dr. Howe, and we would be glad to hear from him.

MR. ELLWOOD WILSON: It is very kind of you to ask me to say a few words. I only want to say what I said a few years ago when I first realized the condition which Dr. Howe has so ably described this afternoon.

In going over our cut-over lands in 1908, I gained the impression that we were in error in thinking we could cut continuously. I brought the matter to the attention of several people—and you all know the fate of the reformer. At any rate, now that your Commission have taken this matter in hand through Dr. Howe and are speaking authoritatively, I will not hesitate to say that the greatest need to-day in forest conservation in Canada is that the provincial governments and the Dominion Government should realize the absolute necessity of having reliable information about their lands, the timber on their lands, and the factors involved in the growth and reproduction of trees.

'Mining'  
the Forests

The province of Quebec and the province of Ontario receive very large revenues from the forests. The Quebec Government receives in the neighbourhood of \$1,700,000 a year. Practically speaking, very little of this is spent for any useful purpose in learning what we have or the conditions that govern growth and reproduction on our forest lands. The province is 'mining' its forests as rapidly as possible.

The consumption of pulpwood in the St. Maurice valley has increased 200 per cent in the last five years. The forest simply cannot stand the drain. Why all the money which is being spent on the forests should be devoted to administrative work is beyond me. It is necessary, of course, to do a certain amount of administrative work; but why we should go longer in blindness when we are getting such large revenues from these lands, I do not understand. Every possible facility is offered for experimental work of the character Dr. Howe has been engaged in; but the impetus to all this kind of work has to come from this Commission. It is certainly strange that the men in charge of our governments do not realize the necessity of investigating these great public questions. Assuredly, we should congratulate ourselves that we have this Commission to take up these matters and lay them before the governments and the public until public sentiment is aroused to the necessity for action. It is getting pretty far along in the day to begin this kind of work; if we do not get at it soon, we shall be shutting the door after the horse is stolen.

Experimental  
Work Needed

The conditions described by Dr. Howe extend over very large areas in the valley of the St. Maurice, with a watershed of 16,000 square miles. Thirty five per cent has been burned over, and practically the same area lumbered, so that the remaining virgin forest is not a very large proportion, and the rapidity with which it is being exploited is becoming alarming. The industries which depend on the forest are so important that it certainly is time some experimental work was commenced.

I note with a great deal of pleasure that the Dominion Government is beginning similar work at Petawawa, but it is not being carried as far as it should be. A very small staff in each province could do a great deal of work. This has been demonstrated by your work in British Columbia, which has been most valuable.

In talking with Colonel J. B. White who has just returned from the front where he has been in charge of the Forestry corps, one learns what an absolute necessity timber is in the carrying on

of war, and we owe it to ourselves to learn more about the conditions which influence the growth and reproduction of our forests, and which Dr. Howe has so ably presented to us this afternoon. I would urge on the Commission to take up with the Provincial and Dominion Governments the desirability of trying to work out these problems and getting some experimental data that will enable us to solve them correctly, so that our forests may be preserved not only for our own, but also for future, generations.

SENATOR EDWARDS: One of the greatest evils that has existed is that the provinces have enormously over-estimated their timber resources. They think they have so much timber that it is not necessary for them to take care of it, and burning and improper cutting have gone on unchecked. Forest fires have destroyed many times as much as the lumberman's axe.

Dr. Howe knows that if he starts experimental work, he will have to make an enormous number of experiments. Even in the St. Maurice valley he will find conditions governing the production of timber vary as he goes from south to north. Again, the conditions in the Maritime Provinces differ from those in the St. Maurice district, and so on throughout the entire country.

The popular idea has been that you have only to go northward to obtain more timber. But, except on the Pacific and the Atlantic coasts, the timber deteriorates as you go northward, and, when you get two hundred miles north of Ottawa, it is of little value, and the growth is very slow indeed.

If there is a country possessing public men who know nothing of their country, it is Canada, and I invite the people of Canada to study their country and learn something respecting it. If they did this, far different conditions would exist. The popular idea is that Canada has simply untold wealth in so far as lumber is concerned. That is not the case. East of the Rocky mountains, the saw-timber of Canada is pretty well exhausted. We have yet a large asset in our pulpwood resources, but, unless they are conserved, it will be only a short time until they, too, are depleted.

Large quantities of our spruce and balsam are wasted annually simply because the old timber is not cut. A lumberman should have a large area in proportion to his cutting capacity, and should cut only the old and mature timber. Some of our limits that were supposed to be exhausted fifty years ago are still being lumbered. Judicious cutting on the part of the lumbermen themselves will solve the question of reproduction. I may be wrong, but that is my opinion gained from a very long experience.

I am a little astonished to hear Mr. Wilson's statement respecting the St. Maurice valley. His company and other companies there have made a fatal mistake in building such enormous pulp mills and so many of them, with the limited resources of pulpwood they have. I am not surprised at their awakening.

DR. F. D. ADAMS: I have been very much interested indeed in the valuable address Dr. Howe has just given us. It is especially interesting as supporting the action which the Advisory Council on Industrial and Scientific Research has taken in advising the Government to establish experimental forest stations similar to those established in connection with agriculture. When the Council was formed for the purpose of advising the Government with reference to the manner in which money should be expended for industrial and scientific research, the committee which had to deal with forestry consulted various foresters in the Dominion and were advised that one of the best ways in which to recommend the Government to expend money would be in the establishment of a number of experimental forest stations, exactly as Dr. Howe has indicated.

It was found that there were not a sufficient number of foresters in Canada whose services could be secured, to properly man more than one of these stations, and so the Council recommended that the Government take 100 square miles in the rear of the Petawawa reserve and, with the co-operation of the Department of Militia and Defence, establish just such an experimental station as has been recommended. The Council was given the necessary money to carry on this work for a year, and intends to recommend the Government to continue that work indefinitely and also to establish a number of other experiment stations in various parts of the country where the forest conditions differ. We hope in this way to get, eventually, just the information which Dr. Howe says is so necessary to enable us to understand what steps should be taken in order to conserve, perpetuate and increase the productivity of the forests.

MR. J. N. STEPHENSON (Editor, *Pulp and Paper Magazine*): Experiments in the manufacture of iron and steel began centuries ago, and if such an early beginning had not been made, we would not have made such progress as we have in the iron and steel industry. As Colonel J. B. White remarked last Friday at the meeting in Montreal to organize a Woodlands Section of the Canadian Pulp and Paper Association, if France had not adopted conservation measures with their forests 200 or 300 years ago, we would have been in a very bad way over there just now.

We are not, as I take it, planning this work in forestry for ourselves or even for our children. Canada is to live forever, and

the work that is begun now is to be of permanent good and benefit to all those who come after us. If we do not begin now, as Col. White said, we will be worse off in one hundred and fifty years than we are to-day; and, as in the case of the iron and steel industry, we must have facts on which to base progressive measures, and these we cannot get without experimentation. I am not a forester, but I am a chemist, and I know there is no possibility of advance in chemistry except that which is based on the determination of truth by experimentation. The sooner we begin this work, the greater will be the advance made. The beginning made in recording growth measurements by Dr. Howe is one of the most important steps yet taken to insure the perpetuation of our forest-born industries.

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# Power Possibilities on the St. Lawrence River

BY

ARTHUR V. WHITE

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**I**N May, 1908, nearly ten years ago, the Conference of Governors was called together in a memorable session at Washington by the President of the United States. It resulted in the formation of the Commission of Conservation of Canada, and policies adopted at that conference and subsequently carried into effect, have markedly affected, not only the United States but also Canada and, indeed, the world at large. It was, also, so clearly demonstrated that several of the chief natural resources of the United States were within measurable distance of exhaustion, that prompt action by the trustees of the nation became imperative.

Addressing the Conference, the President of the United States, Mr. Roosevelt, said:

"This nation began with the belief that its landed possessions were illimitable and capable of supporting all the people who might care to make our country their home; but already the limit of unsettled land is in sight, and indeed but little land fitted for agriculture now remains unoccupied save what can be reclaimed by irrigation and drainage. . . . We began with an unapproachable heritage of forests, more than half of the timber is gone; we began with coal fields more extensive than those of any other nation and with iron ores regarded as inexhaustible, and many experts now declare that the end of both iron and coal is in sight . . . The enormous stores of minerals, oil and gas are largely gone . . . Our natural waterways are not gone, but they have been so injured by neglect, and by the division of responsibility and utter lack of system in dealing with them, that there is less navigation on them now than there was fifty years ago. Finally, we began with soils of unexampled fertility, and we have so impoverished them by injudicious use, and by failing to check erosion, that their crop-producing power is diminishing instead of increasing. In a word, we have thoughtlessly, and to a large degree unnecessarily, diminished the resources upon which not only our prosperity but the prosperity of our children and our children's children must always depend."

The Commission of Conservation of Canada has been endeavouring to have our natural resources so developed that they will, so far as possible, be passed on to succeeding generations unabused by the uses to which they must now be applied. Special attention has been

devoted to the beneficial use and conservation of Canada's water resources, and some of our earliest activities consist of investigations respecting the character and extent of the water-powers of Canada. In presenting the results of its research, the Commission, from time to time, has advised respecting such subjects as water-power development, the improvement of navigable rivers, the necessity for protecting against damage by flood, the preservation of soils against erosion, and the conservation of underground waters.

Some resources such as minerals—more especially coal, oil, and gas—if used, must eventually become exhausted. On the other hand, such resources as the soil, forests, waterways and ground waters, may be conserved, and, just as a good husbandman passes on his farm in an improved condition to that in which he received it, so the policies advocated by this Commission have been directed to the passing on to succeeding generations in an improved condition, the heritage of the natural resources of Canada.

**Power Shortage  
in Eastern  
Ontario**      The water-powers of the St. Lawrence river are, as yet, largely within the control of the people. There is, however, a shortage of hydro-electric power which is being keenly felt both in Canada and the United States, and strong efforts are being made by private interests to obtain control of the enormously advantageous power in, and adjacent to, the international boundary waters.

The city of Montreal and vicinity are well supplied with electric energy but, comparatively speaking, the rates are high. If more energy were available at considerably lower rates, electric power and light would be much more extensively used both in factory and home. If large supplies of electric energy be made available at low rates, rigid inspection should be enforced to prevent extravagant and wasteful use.

There has been great shortage of power for supplying municipalities in Eastern Ontario. At the present time, the Hydro-Electric Power Commission of Ontario has urgent requests from such municipalities as Brockville, Prescott, Winchester, Chesterville, Cornwall, Mille Roches, Smiths Falls, Perth, Carleton Place, Kemptville and Almonte, for electric power to take care of connected loads aggregating from 15,000 to 20,000 h.p., with a present peak load of not less than 8,000 h.p.

Although Eastern Ontario is not so extensively engaged in manufacturing as Southwestern Ontario, it is well to recall that in the autumn of 1910, when the Ontario Hydro-Electric commenced operating its Niagara system, it was supplying only about

8,000 h.p. On this system alone, it is now, December, 1917, supplying more than 100 municipalities with over 200,000 h.p., and, in addition, some 50,000 h.p. is supplied to munition plants in the Niagara district.

**Canadian Power for U. S. Municipalities** The power shortage in Eastern Ontario is acute. It had been hoped that power would have been available from the large development at the Cedars on the St. Lawrence river, but this power, although conveyed through the territory of the municipalities requiring power was taken *en bloc* to the works of the Aluminum Company of America situated at Massena, N.Y. Notwithstanding the suggestion that the needs of Canadian municipalities might be supplied by power brought back from Massena to Canada, this has not been done, but, instead, it is being sold to municipalities in the northern part of New York State. Great industrial advantage has followed the utilization of this power generated in Canada and exported to the United States.

During recent Hearings, conducted at Niagara Falls, N.Y., and elsewhere, by the Committee on Foreign Affairs of the House of Representatives, two points were prominently emphasized by representative citizens; first, that the United States could not afford to permit the removal of industries to other countries to secure cheap power and, second, that industries requiring large blocks of power were often compelled to go where they could get it. The United States has already lost industries to Norway and to Canada.

**Public Opinion Against Exportation** There is very strong opposition, especially throughout Ontario, to any policy which permits our exportation of electric energy required for use in Canada.

The Federal Government has been memorialized upon this subject. It has been urged that no large power projects such, for example, as those on the international portion of the St. Lawrence river, should be developed without reserving Canada's share of the power for use here; and, further, that powers situated wholly in Canada should be reserved against the day of Canada's need. This statement is made having in mind the fact that it is not the policy of Canada to embargo her exports but that commodities of national importance should not be exported without an adequate *quid pro quo*.

If power is developed, as is proposed at the Coteau rapids, it is much more important that it be reserved for the use of such municipalities in Quebec and Ontario as would naturally be served thereby, than that it be exploited by private interests, or exported to build up industries in the United States. The proposed application of the Power Development Co., Limited, for the rights of power

development at the Coteau rapids\* is being opposed by the Commission of Conservation and other organizations.

**Coal Situation** As never before, the public interest has been aroused respecting both its fuel supply and its increasing dependence upon hydro-electric energy. The central portion of Canada depends upon the United States for its coal, and war conditions are driving home to Canadians the tremendous gravity of their position.

The extent to which electric energy will be available for heating has been much overrated and, realizing the underlying physical limitations, one cannot be enthusiastic respecting the extent to which it will be utilized. Of course, where large blocks of power are available at low rates, some will doubtless be so used. The availability of such power accounts for the establishment of large electro-chemical industries at Niagara and other centres, but, when the demand for power for municipal and small manufacturing purposes becomes more urgent, such works will probably be forced to leave present sites. Manufacturers and others who are ready to pay from \$50 to \$100 per electric horse-power year, will not readily submit to industries utilizing the coveted power at rates of from \$10 to \$20 per horse-power.

What I said in 1910 on the coal situation is equally true today:

"Certainly the people of Canada are in better circumstances to maintain a supply of heat and power if their water-powers, including their full share of international water-powers, are reserved to themselves and not permitted to be exported except upon terms and conditions which will conserve absolutely the present and future interests of the citizens of Canada. Not only would the water-powers of Canada provide, to a certain extent, a substitute for the coal supply of the United States as a means of furnishing light, heat and power, but control of these water-powers would secure a basis upon which negotiations for coal could be conducted in a possible day of need. Canada would be in a position to exchange, if need be, part of her electric energy for part of the coal supply of the United States. It is obvious, however, that if the United States' interests should control both the coal and the water-powers, the situation of Canada would become exceedingly grave."<sup>†</sup>

\*For Notice of Application to the Dominion Government, made by this company under the *Navigable Waters Protection Act*, R.S.C., chap. 115, see *Canada Gazette*, Sept. 22, 1917, p. 969.

<sup>†</sup>Respecting various phases of this subject, consult articles by Arthur V. White on *Exportation of Electricity* in *University Magazine*, October, 1910, pp. 460 *et seq.* and *Exportation of Electricity—An International Problem: Relation of a Possible Coal Embargo by United States to a Curtailment or Stoppage of Canada's Electric Power*, in *Monetary Times*, January 5th, 1917, pp. 21 *et seq.* Consult also, *Toronto World*, March 18th, 1912; also *Annual Reports* of Commission of Conservation, Ottawa.

Concentration  
of Control

Upon this, it is not necessary for me to enlarge, but I shall deal more particularly with the shortage of hydro-electric energy. Most of the water-powers which are more readily capable of economic development in Canada, as well as in the United States, either have already been developed or are privately controlled. Concentration of ownership is a noticeable feature of this control. It has been authoritatively stated that, in the United States, in 1913, about 6,300,000 h.p. was controlled by ten groups of interests, and this concentration is still going on. Owing both to Provincial and Federal legislation, it has not been possible for interests so readily to obtain control of water-powers in Canada. Efforts, however, are continually being made to secure the rights for such desirable water-powers as are yet vested in the state. In this connection, the efforts made by the powerful financial interests behind the Long Sault Development Co. to obtain control of the almost unequalled power rights at the Long Sault rapids on the St. Lawrence river, are particularly pertinent.

Of the extent to which they may be compelled to pay tribute to those monopolizing hydro-electric powers through control of distribution and supply systems, the public cannot be too well informed. On this point, Mr. Gifford Pinchot has said:

"Whoever dominates power, dominates all industry. Have you ever seen a few drops of oil scattered on the water spreading until they formed a continuous film, which put an end at once to all agitation of the surface. The time for us to agitate this question is now, before the separate circles of centralized control spread into the uniform, unbroken, nation-wide covering of a single gigantic trust. There will be little chance for mere agitation after that. No man at all familiar with the situation can doubt that the time for effective protest is very short. If we do not use it to protect ourselves now, we may be very sure that the trust will give hereafter small consideration to the welfare of the average citizen when in conflict with its own."

Respecting the attempt to create a monopoly of water-powers of the United States, President Roosevelt, in accurate prophetic terms stated:

"The people of this country are threatened by a monopoly far more powerful, because in far closer touch with their domestic and industrial life, than anything known to our experience. A single generation will see the exhaustion of our natural resources of oil and gas, and such a rise in the price of coal as will make the price of electrically-transmitted water-power a controlling factor in transportation, in manufacturing, and in household lighting and heating. Our water-power alone, if fully developed and wisely used, is probably sufficient for our present transportation, industrial,

municipal, and domestic needs. Most of it is undeveloped and is still in national or state control. To give away without conditions, this, one of the greatest of our resources, would be an act of folly. If we are guilty of it, our children will be forced to pay an annual return upon a capitalization based upon the highest prices which 'the traffic will bear.' They will find themselves face to face with powerful interests entrenched behind the doctrine of 'vested rights' and strengthened by every defence which money can buy and the ingenuity of able corporation lawyers can devise. Long before that time they may, and very probably will, have become a consolidated interest, dictating the terms upon which the citizen can conduct his business or earn his livelihood, and not amenable to the wholesome check of local opinion."

Canada cannot afford to have her St. Lawrence River powers pass into the hands of powerful private interests.

**St. Lawrence River Situation** There has been a marked general tendency to exaggerate the quantities of water-power capable of development. Tentatively, however, let us assume that practically the full low-water flow of the St. Lawrence river is available for power development.

Power development on this river cannot, however, be properly considered apart from the subject of the ice menace. Too great caution cannot be exercised before attempting to harness natural forces of such magnitude as exist in the flow of the St. Lawrence river. Too radical a disturbance of the balance which nature seeks to maintain may cause disaster, and it is well to emphasize these aspects of the problem, for they involve the weighing of basic physical factors of paramount importance.\*

If large development should take place, considerable quantities of power would probably, for a time at least, be utilized by electro-chemical industries. With such large power users, the tendency of vendors of electrical energy, is to stipulate that such customers must curtail consumption whenever the supply of generated power is reduced owing to unavoidable causes. By means of such contract arrangements, the requirements of municipalities and of industries requiring smaller amounts of power continuously, may be safeguarded.

**Possible Power Sites** On the St. Lawrence river below lake Ontario, the first site where a development involving the whole flow of the river could be made, is in the vicinity of Morrisburg. With a dam near the foot of Ogden island, a head of

\*In the special report—*Long Sault Rapids, St. Lawrence River, an Enquiry into the Constitutional and Other Aspects of the Project to Develop Power Therefrom*, by Arthur V. White, Commission of Conservation, Ottawa, 1913—attention is drawn to the great menace which exists in the ice conditions manifested in the St. Lawrence river.

about 11 feet could be obtained, or, taking in a portion of the Galop rapid, possibly a total effective head of about 15 feet. If utilization of the Galop rapid be contemplated, the question of regulating works to control the level of lake Ontario has to be considered. In fact, for certain power developments on the St. Lawrence, the regimen of flow from, and storage in, each and all of the Great lakes must be taken into consideration.

The next possible development is that at the Long Sault rapids where a head of about 35 feet may be created. Some authorities state that the head which may profitably be developed is considerably less than 35 feet; others, again, have thought that it might be increased to nearer 40 feet.

Descending the river we have next, in a stretch of about 14 miles between lakes St. Francis and St. Louis, three series of rapids: the Coteau, the Cedars, the Split Rock and the Cascades.

Coming next to the Lachine rapids below lake St. Louis, we have a head of about 30 feet in  $4\frac{1}{2}$  miles. Here 17,000 h.p. is already being developed. The total undeveloped possibilities of the river at this point may be estimated at about 400,000 h.p.

The Cedars Rapids Manufacturing & Power Company utilize at Cedars rapid a head of about 32 feet, developed by means of a diversion canal some two miles long. Ultimately, they will divert 56,000 second-feet. The power house at the foot of the canal is designed for an ultimate development of 180,000 h.p. At present, units aggregating some 100,000 h.p. are installed, and extensions for the complete development are now being made with the immediate addition of two 10,000-h.p. units. This Company is exporting to the United States over 65,000 h.p.

The Soulange plant of the Civic Investment and Industrial Co. is situated a short distance below the Cedars plant. Power is obtained by tapping the Soulange canal through an open headrace half a mile long, the development operating under a head of 50 feet. The installed capacity is some 15,000 h.p., the amount of water available for the plant being subservient to the requirements of navigation through the canal.

The St. Timothée plant of the Canadian Light and Power Co. is on the south side of the St. Lawrence, directly opposite the two last-mentioned developments, and utilizes the descent of both the Coteau and Cedars rapids. The water is led through a portion of the old Beauharnois canal, 7 miles in length. A head of 50 feet is thus obtained. The development is for an ultimate capacity of 75,000 h.p., but the present installation is only for some 30,000 h.p.

At Mille Roches, the St. Lawrence Power Co. has a hydro-electric plant utilizing a portion of the descent in the Long Sault. The development includes a dam which forms an enlargement of the Cornwall canal, with a short, open flume leading to the power plant. The total capacity installed is 2,500 h.p., the equipment operating under a nominal head of 30 feet.

The Beach hydro-electric plant is situated at Iroquois, and utilizes a head of about 12 feet. The present installation is for some 600 h.p. Extensions had at one time been planned to bring it to a total capacity of 2,400 h.p., but were abandoned as they would have seriously interfered with navigation.

There are also two hydro-electric plants at Morrisburg, having a nominal water-wheel capacity of about 1,250 h.p., and yielding about 900 h.p., under a head of 10 feet.

*St. Lawrence Water-power* To summarize, we may place the estimated low-water power of the international portion of the river

St. Lawrence at about 800,000 h.p., of which Canada is entitled to one-half, or 400,000 h.p. The estimated low-water power on the portion of the river which lies wholly within Canada would be about 1,400,000 h.p.

This, with its share of power along the international boundary, makes an estimated total for Canada of 1,800,000 low-water continuous horse-power. It is detailed in the following table:

WATER-POWER ON THE ST. LAWRENCE RIVER\*  
(Tentative schedule)

| Site                             | Head available | Estimated low-water<br>24-hr. h.p. | Average<br>estimated<br>24-hr. low-<br>water h.p. |
|----------------------------------|----------------|------------------------------------|---|
| Morrisburg-Rapide Plat.....      | 11-15          | 170,000-230,000                    | 200,000   |
| Long Sault rapid.....            | 30-40          | 500,000-650,000                    | 575,000   |
| Coteau rapid.....                | 15-17          | 230,000-260,000                    | 250,000   |
| Cedars rapid†.....               | 30-32          | 490,000-525,000                    | 500,000   |
| Split Rock and Cascades rapids.. | 14-18          | 220,000-280,000                    | 250,000   |
| Lachine rapid.....               | 20-30          | 300,000-450,000                    | 375,000   |
| Total.....                       | .....          | 1,910,000-2,395,000                | 2,150,000   |

\*In this table, to have the estimates fairly representative of the possible quantities which might be expected under representative low-water flow conditions, some allowances have been made for efficiency and other factors.

† Under development for about one-third of the low-water flow of the river. Consideration would be given to the possibility of combining the Coteau, Cedars, Split Rock and Cascades; also of increasing the Lachine power.

By adjusting their deliveries, vendors of power are frequently able, during certain hours, to sell power which, during other hours, is used by another consumer. For instance, the Hydro-Electric Power Commission of Ontario, by taking into consideration what is technically known as the 'diversity load factor' can, with a power capacity of 250,000 h.p., supply contract requirements of 320,000 h.p.; therefore, assuming such a basis for the St. Lawrence River powers, Canada's 1,800,000 h.p. would take care of a power demand of some 2,400,000 h.p.

What 65,000 h.p. Few people have any conception of what the 65,000 h.p., now being exported to the United States from Could Do the Cedars, could do if widely distributed to customers of light and power. It is worth while to try to realize just what such an amount of power signifies. In 1916, a little less than 50,000 h.p. met the requirements for light and power of the 40,000 customers of the Toronto Hydro-Electric Power Commission. The rates for light and power in Toronto are low, much lower, for example, than in Montreal. Including the requirements of the Toronto Street railway, the Toronto Electric Light Company, and the Toronto Hydro-Electric Power Commission, 120,000 h.p. is now required for light and power in the municipality of Toronto. Therefore, the 65,000 h.p. exported from the Cedars would, if retained in Canada, supply, at cheap rates, all the light and power required by a manufacturing city of 300,000 inhabitants. If distributed through Canadian municipalities, it would supply light and power to some 35 manufacturing cities of 10,000 inhabitants each; or it would practically take care of one-third of the present demands of the Niagara system of the Hydro-Electric Power Commission of Ontario, which supplies over 100 municipalities and 100,000 purchasers of electricity.

A comparison of the benefits resulting from power thus widely distributed, with the localized benefits from the same power utilized in bulk, as in the electro-chemical industries, demonstrates that the former contributes in a much greater degree to the upbuilding of communities and to the growth of the country at large.

Canada's Markets Coveted Is it surprising that the former United States Secretary of War, Hon. Henry L. Stimson, respecting Niagara power, stated that:

"The investigation which has been made by the engineers indicates that Canada, if we do not take it, will use the entire amount that the treaty permits in a very brief time . . . and it would result in giving to Canada, very possibly, a large number of industries which otherwise would be established on this side of the falls."

Is it surprising that, in a report to the Chief of Engineers, U.S.A., Lieut.-Col. J. C. Sanford, stated that:

"If advantage of power generated in Canada cannot be had on the American side, manufacturers will be attracted to Canada by this cheap power, and the industries of this country [the United States] will suffer accordingly. The effect of present restrictions on the importation of power is becoming noticeable . . . Manufacturers at present contracting for additional Niagara power must locate, and are locating, in Canada."

It is noteworthy that the sub-committee on Niagara Falls power, appointed by the Committee on Foreign Affairs, United States House of Representatives, states that it had been urged for its attention:

"That the Canadian companies were rapidly increasing their sales and would very soon take the full amount of water they were entitled to and the United States ought to get what power it was able to *now*. . . . If the advancement in the development of power on the Canadian side increases for another year or so—and it is not apparent to the Committee that it will not—then the Committee concluded that it was proper to take as large an amount as it could get for consumption in the villages, cities, factories and homes along *our* border."

Now, if, after taking the vital subject of Canada's coal supply into full consideration in its international aspect, it is found that the electrical energy generated in Canada can be retained for use here, results will be achieved which are unobtainable if the electricity is exported to the United States.

Canadians should appreciate the fact that the United States has been dealing with them generously in the present distressing coal situation. Portions of the United States are as badly off for coal as portions of Canada. Between the United States and Canada there is an exchange of many natural and manufactured products, and the problems which arise, from time to time, in connection with such interchange can be satisfactorily solved, and the whole situation reduced to a good working basis. Canada, however, must conserve against the day of her own need such resources as are available for barter. These problems call for the best statesmanship which Canada can bring to bear upon them, and, only by a knowledge of all facts relating to the subject, can a wise administrative policy respecting our fuel and power problems be formulated and carried out.

# The Niagara Power Shortage

BY

ARTHUR V. WHITE

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THIS paper considers, briefly, the present power shortage in the portion of Southwestern Ontario which is served from Niagara falls.

The extent to which consumption of electricity has increased may be judged from the increase in consumption by municipalities served from the Niagara system of the Hydro-Electric Power Commission of Ontario. When the Commission was initiating its operations, the late Premier, Sir James Whitney, though a staunch supporter of the project, stated to the Chairman, Sir Adam Beck, that the Commission would not require 10,000 h.p. The Commission's estimates of its yearly requirements have been amply vindicated.

Hydro-Electric Power Commission of Ontario      The Commission is directing the following systems: Niagara, Severn, Wasdell Falls, St. Lawrence, Smiths Falls, Ottawa, Port Arthur, Eugenia, Muskoka, Northern Ontario and Central Ontario. The capital investment of the province of Ontario in connection with these, and including the purchase price of the Ontario Power Company at \$22,450,000, and of the Central Ontario system at \$8,350,000, is approximately \$48,500,000. In addition, the municipalities have a total investment of over \$21,000,000 in connection with their local distribution and operating systems.

The Commission serves over 121,000 customers of whom 117,000 are light, and 4,000 are power consumers. It supplies over 200 municipalities and operates about 3,000 miles of transmission lines. In short, over half the population of Ontario is supplied with electricity through its agency. Its contracts with the *municipalities* for the August 1917 load, total about 159,000 h.p. and the December 1917, load is estimated at about 201,000 h.p.

**Municipalities  
Enthusiastic  
Over System**

It has been authoritatively stated that, based on prices prevailing before the Commission's operations became effective, the estimated saving during 1916, to light users only, was over \$5,000,000. Notwithstanding statements by opponents of the Hydro-Electric Power Commission of Ontario that the project had not been a success, the various municipalities are enthusiastic over the success of the undertaking and the benefits which have resulted to them individually. Some 200 municipalities, served through the agency of the Commission, and which have invested some \$70,000,000, passed the following resolution at the Toronto meeting of the Ontario Municipal Electric Association on October 16th, 1917:

"We, the members of the Ontario Municipal Electric Association, desire to renew and reaffirm our fullest confidence in Sir Adam Beck and the Hydro-Electric Power Commission of Ontario, realizing his untiring efforts and his unselfish devotion to the interests of the people of this Province, and the magnificent results achieved by the Commission's honest and efficient administration of this great public service utility, and we pledge him our united support in his fight to conserve the rights of the municipalities in the Niagara and St. Lawrence rivers."

**Increase in  
Consumption**

The yearly loads of municipalities in the Niagara district, including a few special industrial contracts made for long-term periods, are as follows:

|                       |         |             |
|-----------------------|---------|-------------|
| 1910.....             | 8,000   | horse-power |
| 1911.....             | 12,000  | "           |
| 1912.....             | 28,700  | "           |
| 1913.....             | 50,470  | "           |
| 1914.....             | 82,161  | "           |
| 1915.....             | 110,654 | "           |
| 1916.....             | 150,000 | "           |
| 1917 (estimated)..... | 205,000 | "           |
| 1918 (estimated)..... | 250,000 | "           |

**An Acute  
Shortage**

The present available supply of power for the 200 municipalities served by the Hydro-Electric Commission is exhausted. The shortage is acute. In October, 1917, the Secretary of the Commission sent an official notice to municipalities advising that, pending completion of the inquiry by Sir Henry Drayton respecting the power situation at Niagara Falls, as well as the inquiry held before the three judges appointed under the Water-powers Regulation Act, "no further contracts be entered into for a supply of power nor for an increase in the load of the present power users."

**Growing Demand in Toronto**

The Toronto Hydro-Electric Commission obtains power from the Hydro-Electric Power Commission of Ontario and distributes it in Toronto. It commenced operations June 1, 1911, with about 400 customers. At present (November, 1917) it has over 50,000 customers and has expended about \$8,000,000. To take care of the December, 1917, load will require about 75,000 h.p., but only about 50,000 h.p. is available.

The Toronto Commission is exerting every effort to compress its load, and to prevent even the natural increase in the requirements of its present customers. It can take on no new customers and has been issuing special appeals to present customers to use as little current as possible, particularly from 4.30 p.m. to 6 p.m.

"on Mondays, Tuesdays, Wednesdays, Thursdays and Fridays, and so help to avoid a possible power shortage for munition plants and other essential industries. . . . Every economy, however small, will help to achieve the result aimed at. If each of the 50,000 Hydro customers in Toronto uses even one or two lights less during these hours, it will mean a greater reduction than if the whole of the street lights in Toronto were turned off."

Undoubtedly, much power and light are absolutely wasted. Not very long ago, the vendors of electric energy were offering special inducements to encourage consumption, and customers were invited to use new electric devices as rapidly as such could be invented. The public has responded to these invitations and now, assuming that there is no set-back to industrial activity, Ontario is faced with a power shortage which, until relieved, must constitute a serious check to her industrial growth. The time is at hand when drastic action must be taken to curtail the use of electric energy now employed on luxuries, and thus make it available for necessary purposes.

**Making War Materials**

The average individual has little idea of how diverse and extensive are the demands upon manufacturers for materials of war. A recent photograph shows a French soldier at his post with such individual equipment as: rifle, grenade-throwing gun, pistol, package of powder to be used against gas, a basket of hand grenades, sand bag, pickaxe, gun-grenades, signal lantern, alarm bell for gas attacks, small reel of barbed wire, rocket scoop, corrugated iron hatch-grate, shovel, wire-scissors, broom, gun-carrier with periscope, and a gabion.

The Ontario Hydro-Electric Commission at such centres as Niagara Falls, Welland, Toronto, Hamilton, Dundas, London, St. Catharines, Brantford, Kitchener, St. Thomas, Stratford, Guelph,

Galt, Sarnia, Woodstock, Paris, Preston, Walkerville, Wallaceburg, Seaforth, etc., is supplying power for manufacturing munitions of war such as abrasives, aeroplanes, aluminium, beds, blankets, boots, brass sockets, brushes, camp ranges, carbide, castings, chemicals, clothing, cloth wire, cutlery, flour, fuses, harness, kit bags, primers, provisions, rifles, shells, shell parts, shell boxes, shell-making machinery, special lanterns, steel plugs, special tools, waggons, etc.

**Electro-Chemical Uses** The uses to which electric energy in large quantities is applied in the electro-chemical industries, are well described by a statement recently made by Mr. F. J. Tone of the Carborundum Company, Niagara Falls, N.Y. He says:

"The part set for Niagara industries in the war programme is a large one. They must supply the bulk of the ferro-alloys, the all-essential of the steel industry. Ferro-chrome is wanted for armour plate and projectiles. The army must have chlorine for gas shells, camp sanitation, water purification and for the Dakin solution. Explosive makers want caustic soda, potassium chlorate and chlorobenzol. Dirigibles require silicon for generating hydrogen. Destroyers want phosphorous for smoke screens. Abrasives, cyanides, aluminium, electrodes and many other products are urgently needed in the war game. The Aircraft Production Board has decided on the design of the standardized United States aeroplane motor. It will require quantities of ferrochrome for chrome-steel crank shafts, chrome-steel connecting rods and all parts subjected to the enormous strains of a mechanism weighing less than 2 lbs. per horse-power. Quantities of aluminium will go into crank-cases and pistons. The modern grinding wheel alone makes possible the finishing to limits of a fraction of a thousandth of an inch all parts of the aeroplane engine and, thus, the artificial abrasives of Niagara become the key to interchangeability."

**Power for War Munitions** In August, the munition plants supplied with power by the municipalities and the Commission from the Niagara system were taking a total of over 78,000 h.p. with *firm* contracts amounting to 94,600 h.p. Some of this power cannot be supplied without cutting off other customers. Additional present demands from the Union Carbide Co., the Electro Metals Co., and other munition manufacturers, total over 45,000 h.p. In August, the Ontario Power Co. was supplying some 44,600 h.p. for munitions and war materials. This makes a total demand upon the Hydro-Electric Power Commission and the Ontario Power Co. for munitions, of over 186,000 h.p. Of this, however, 30,000 to 35,000 h.p. may be considered as 'off-peak' power, leaving a net requirement of some 150,000 to 155,000 h.p.

The shortage on the Niagara system for munition plants supplied with power by the Commission and the municipalities alone, may be placed at about 65,000 h.p. It is very interesting to note that, as a result of the campaign conducted through the daily press and by means of other agencies, the various municipalities have so adjusted consumption of electricity within their respective jurisdictions as to reduce the load *on peak* by from 20,000 to 30,000 h.p.

**Relief of  
Shortage**

The following are some of the means by which this shortage may be supplied:

1. Increased utilization of steam power. This, at the present time, is out of the question as a means of dealing with the problem as a whole.

2. Supplying temporarily, water from the unappropriated surplus, thus permitting the utilization of the excess capacity of the plants at Niagara. It has been stated in the press that this has been provided for.

3. Curtailment of the power now used for street and other lighting, such, for example, as ornamental lighting; also for certain power purposes, in order to liberate more power for manufacture of munitions.

4. Utilizing the water of existing plants under more efficient conditions, such as will exist in connection with the new Chippawa project, which will operate under a head of 300 to 305 feet. It will, however, be approximately three years before relief can be obtained by such means.

The Hydro-Electric Power Commission of Ontario is moving as rapidly as possible to have additional equipment, including pipeline, installed, so as to have available in about ten months, an additional 50,000 h.p. from the plant of the Ontario Power Co.

5. Limitation of the quantity of power at present being exported from Canada to the United States. As manufacturers of war munitions in the United States also are short of power, such limitation will require very careful consideration in its international aspects, so that full justice will be done to interests on both sides of the boundary.

**Chippawa  
Project**

The new Chippawa project which the Hydro-Electric Commission has started will, with the surplus water available, provide about 200,000 h.p., but, as stated above, cannot be available for approximately three years. The proposed size of the individual units, namely, 50,000 h.p., is larger than in any other hydraulic development in the world.

Considerations of efficiency and desirable operating characteristics which it would be impossible to obtain with smaller units, have prompted the adoption of such large units. Power is to be produced at considerably lower cost than \$9.00 per h.p. per year, which the Commission has been paying the Ontario Power Co. for the 100,000 h.p. covered by the original contract.

As the Hydro-Electric Power Commission of Ontario now controls the Ontario Power Company, the unused water allotted to the Ontario Power Company will, it is stated, be diverted to augment the water supply available for the Chippawa project. If so, the capacity of the new Chippawa plant will be about 300,000 h.p. instead of the 200,000 h.p. above mentioned.

Preliminary work upon this project, embracing surveys and other engineering activities, has been carried on during the last three years. Plant-equipment and tools for carrying out the work of construction were purchased some time ago and much of this equipment is on the ground ready for operation.

**Quantities of Power** The table given below includes the quantities of power available, capable of development, exported, used for munitions, etc. In considering these figures, it should be fully understood that they vary from day to day. In many instances, they have been derived from data supplied through the courtesy of the Hydro-Electric Power Commission of Ontario. They are representative of conditions as in October, 1917, and are the latest available.

The capacity of the large power plants in Canada at Niagara Falls may be stated as follows:

|                                | Rated capacity<br>of present<br>installation | Approximate<br>maximum<br>generation capacity |
|--------------------------------|--|---|
| Canadian Niagara Power Co..... | 112,500 h.p.                                 | 100,000 h.p. (a)                              |
| Ontario Power Co.....          | 159,000 h.p.                                 | 162,000 h.p. (b)                              |
| Electrical Development Co..... | 135,800 h.p.                                 | 125,000 h.p. (c)                              |
|                                | 407,300 h.p.                                 | 387,000 h.p.                                  |

The combined loads of the Ontario Power Company and the Ontario Hydro-Electric Commission are<sup>(d)</sup>:

|   |              |
|---|--------------|
| Total connected load.....                               | 519,000 h.p. |
| Required for the December 1917 load.....                | 311,000 h.p. |
| Required generator capacity for this December load..... | 300,000 h.p. |

(a) At times, has generated about 103,000 h.p.

(b) At times, has generated about 163,000 h.p.

(c) At times, has generated 146,000 h.p., but it is claimed that the water used to generate this amount exceeds the quantity legally usable to generate the 125,000 h.p. specified in the contract.

(d) Includes the export of the Ontario Power Co. to the United States.

The total power supply of the Ontario Hydro-Electric Commission, and the Ontario Power Company is as follows:

|  |              |
|--|--------------|
| Ontario Power Co.....  | 160,000 h.p. |
| Contract with Canadian Niagara Power Co.....                         | 50,000 h.p.  |
| Contract with Electrical Development Co. (a).....                    | 13,500 h.p.  |
| Contract of Ontario Power Co. with Electrical Development Co. (b). . | 13,500 h.p.  |
| Total capacity, Oct. 31, 1917.....                                   | 237,000 h.p. |

The power requirements in December, 1917, of the Hydro-Electric Power Commission of Ontario, Niagara system, are as follows:

|  |              |
|--|--------------|
| Hydro-Electric Comm'n, and Ontario Power Co., in Niagara district.   | 261,078 h.p. |
| Contract with the Niagara, Lockport and Ontario Power Co.....        | 60,322 h.p.  |
| Maximum power demand.....  | 321,400 h.p. |
| Power capacity to serve Canadian loads (c).....                      | 246,000 h.p. |
| Power for Niagara, Lockport and Ontario Power Co., contract (d)... . | 50,000 h.p.  |
| Power actually required.....   | 296,000 h.p. |

Power available to Hydro-Electric Commission and Ontario Power Co., to serve above loads, (e) is:

|  |              |
|--|--------------|
| Capacity of Ontario Power Co.....  | 163,000 h.p. |
| Purchase from Canadian Niagara Power Co.....   | 50,000 "     |
| Contract with Electrical Development Co.....   | 13,500 "     |
| Total power actually available of.....   | 226,500 "    |
| Thus the shortage of power for present customers and firm contracts<br>is—296,000 h.p. less 226,500, namely..... | 69,500 h.p.  |

#### Exportation of Electricity

Consideration of any proposal to curtail the export of electrical energy from Niagara requires a critical examination of the underlying factors. Much has

been said respecting reduction of the amount of electric energy exported to the United States and much misunderstanding has arisen in this connection. The Chairman of the Ontario Hydro-Electric Power Commission has been urging the retention in Canada of a sufficient amount of Niagara power to assist in meeting the present exigencies. If, for example, the amount retained be such as will equalize the quantities utilized in each country, then, our exports would be reduced by about 63,250 h.p.—not, as frequently

(a) This contract, which is that of the Ontario Power Co., expires Oct., 1920.

(b) Expired Oct. 31, 1917, but supply is being temporarily continued subject to new agreement.

(c) Taking account of diversity of load.

(d) By agreement with Hydro-Electric, reduced from 60,000 h.p. during the war.

(e) Assuming contract with Electrical Development Co. is terminated Oct. 31, 1917. As stated above, this energy is being supplied temporarily, subject to new agreement.

stated, 125,000 h.p. The analysis presented below indicates a basis upon which the equity in advantages and disadvantages of present conditions at Niagara, *per se*, may be weighed.

The quantities of electrical power at present being exported to the United States are as follows:

|                                |                       |
|--------------------------------|-----------------------|
| Ontario Power Co.....          | 35,000 to 60,000 h.p. |
| Canadian Niagara Power Co..... | 30,000 to 42,000 "    |
| Electrical Development Co..... | 22,000 to 27,000* "   |
| Total export of about.....     | 125,000 h.p.          |

PROVISIONAL BALANCING OF POWER GENERATED AT NIAGARA FALLS ON  
BOTH SIDES OF INTERNATIONAL BOUNDARY

*United States:*

|  |              |
|--|--------------|
| Niagara Falls Power Company.....                 | 100,000      |
| International Paper Co.....                      | 10,000†      |
| Hydraulic Power Company.....                     | 150,000      |
| Cataract City Milling Co.....                    | 1,000‡       |
| Pettebone Cataract Paper Co.....                 | 4,000‡       |
| Total power generated on United States side..... | 265,000 h.p. |

*Canada:*

|  |              |
|--|--------------|
| Ontario Power Company.....                       | 162,000      |
| Electrical Development Company.....              | 125,000      |
| Canadian Niagara Power Company.....              | 100,000      |
| International Railway Co.....                    | 1,500        |
| Total power generated on Canadian side.....      | 388,500 h.p. |
| Total power generated—United States and Canada.. | 653,500 h.p. |
| One-half total power generated is.....           | 326,750 h.p. |
| Niagara power used in the United States.....     | 390,000 h.p. |

Thus, according to the above analysis, the United States would be utilizing 63,250 h.p. in excess of half of the total amount of power generated, and the retention of this in Canada would make the quantities used in both countries equal.

Canada is exporting electric energy from New Brunswick to the state of Maine; from Quebec to New York; from Ontario to New York and Minnesota, and from British Columbia to Washington.

As pointed out a year ago, no country need be expected to send out of its borders that which is essential to its own existence. Having in mind the present coal situation, it is unnecessary to emphasize the vital importance to Canada of this international fuel and power question.

Canadians should appreciate the fact that the United States has been dealing with them generously in the present distressing

\*Embracing 13,500 h.p. 'on-peak' and 8,000 h.p. 'off-peak' power.

†Chargeable to allotment of Niagara Falls Power Co.

‡Chargeable to allotment of Hydraulic Power Co.

coal situation. Portions of the United States are as badly off for coal as portions of Canada. Between the United States and Canada there is exchange of many natural and manufactured products, and the problems which arise, from time to time, in connection with such interchange can be satisfactorily solved, and the whole situation reduced to a good working basis. Canada, however, must conserve against the day of her own need, such resources as are available for barter. These problems call for the best statesmanship which Canada can bring to bear upon them, and, only by a knowledge of all facts relating to the subject, can a wise administrative policy respecting our fuel and power problems be formulated and carried out.

#### DISCUSSION

SIR JOHN KENNEDY: There are a few points I should like to mention, rather as a continuation of what Mr. White has so ably put before you. Meanwhile, as we are discussing this—and we have discussed the matter off and on for some years—the power is going to waste. How are we to utilize these international water-powers which neither Canada nor the United States acting alone can utilize? There must be a combination of interest, design and execution, before they can be used by either country.

The first need is that the matter should be considered physically as an engineering question, and the second is that it should be considered as an international question, as a matter of diplomacy.

**Physical Obstacles Can be Overcome** The development of the St. Lawrence water-powers between Prescott and Cornwall, as we all know, is a difficult proposition. These powers are at long, low rapids and are therefore much more difficult to utilize than if concentrated in a few large falls. There is also the question of ice. The river flows practically from north to south, the wrong way for water-power development in this northern country. The isothermal lines run almost at right angles to the river, ice breaks at the wrong end and piles against any dam that may be built, flooding adjoining ground and causing many other difficulties.

The engineering question is a very important one; we cannot solve it ourselves nor can the Americans; but it can be solved, it ought to be solved and it will be solved. It is entirely feasible but it can only be done by a combination of engineering effort and ability. It ought to be managed by an engineering commission which should make a thorough survey of conditions and, after careful study, formulate a scheme of development which should then be

handed over to the International Joint Commission for execution. This could be arranged between the two countries.

**Avoid Monopoly**      The St. Lawrence is a navigable river and I hold that the water-power on it should not be handed over to any private interest whatever. The danger of combination has already been pointed out; it is serious, not only for the present generation, but also for future generations. The tremendous power of the St. Lawrence should be kept and developed for the whole people. If we in Canada have power to sell, let us sell it by all means, but under proper conditions. These conditions should be arranged by an international commission. At present, the International Joint Commission is the best authority we have for such a purpose. Under such a commission the whole scheme could be developed, and the power which is now going to waste could be utilized.

**Uniform Control of Power**      One other point I should like to make. On our side of the river, the water belongs to the Federal Government, and, on the American side, to the state of New York, and some arrangement would have to be made by which the power would be controlled in the same way on both sides. The question comes up, at what stage should it be handed over? Should the water be handed over by the cubic foot, or the power by the horse-power, and should the works belong to the community? That is something that requires very careful study. Navigation, as well as power development, must be considered, and, so far as I can see at present, I would have the works belong to the two nations who would sell the water and allow the power to be developed and sold under the guidance of a utilities commission.

**Short-Term Contracts**      The selling of the power should be under public control, and the contracts should be short. No man can see very far ahead. Any engineer looking back over engineering history knows very well that there is scarcely any piece of work built which is good for twenty-five years—not that it is worn out, but that it becomes obsolete very rapidly. It is often better to throw machinery and works into the scrap-heap and rebuild. Thus, whatever contracts are made should be for short terms; we should sell power to the United States just so long as we have a surplus, and no longer. In that way, we can utilize our power resources and benefit our own country. The time is in sight, however, when we shall need practically all the water-power we have. At certain places, we now have a small surplus; at other places, power is very scarce. At Montreal, we would be the better

of a great deal more hydro-electric energy. The same is true in Toronto and through western Ontario.

Of course we are struggling now for our national existence and the making of munitions, which, we hope, will not continue always or even very long, has resulted in a great industrial development and an increased demand for power.

MR. R. A. ROSS: There are one or two points Mr. White has made that perhaps deserve a little more emphasis. One of these is the unity of our sources of power. You cannot consider water-power by itself; you cannot consider steam power by itself; you have to consider them both together. Engineers accustomed to consider power have always used coal fuel as a yardstick to value water-power; whereas the public says "There is water going to waste and you get it for nothing."

**Lack of Knowledge** It has been brought to our minds very strongly within the last few years just what fuel means. We had not realized the fact that we were likely to encounter a situation of this kind, and had not looked over our fuel resources. In spite of the fact that we have in Canada second to the largest fuel resources of any country, and in spite of the fact that we have probably as much water-power as any other country in the world, we are more or less at sea for lack of study of the power and fuel situation as a whole. In certain districts of the country, we have plenty of coal. It can be mined, manufactured and used. But we do not use it economically. In the German Empire, they practically forbid the burning of any raw coal; and force its manufacture into coke, gas, briquettes and other by-products. We have to take up that proposition and to study it in connection with our water-powers, and we have then to supply to any particular district in this vast country of ours that particular form of energy which is the easiest or the cheapest to use.

**Classifying Water-powers** You cannot get water-power in some districts of Canada where you can get unlimited quantities of cheap coal which can be made into fuel. That brings up the question of how we should consider these powers of a size, anything from 100 h.p. up to 500,000. Why should we not hand-pick our sites and set aside for certain uses powers suitable for such uses. For electro-chemical purposes, no one wants anything under 200,000 h.p. When these men come to you they say: "We want 100,000 h.p. at once, but it must have an additional potentiality of 100,000. Moreover, the power must not cost more than \$10 a horse-power year." You can then put aside or hand-pick certain

powers and say: "These can be economically used for this particular purpose."

A power such as that at Niagara, in the centre of districts that are densely populated and are manufacturing centres should be reserved, not for big electro-chemical industries, but for industries that demand a great deal of labour. Hand-picking, for instance, would reveal a situation on the river St. Lawrence that would require some attention.

Sir John Kennedy has pointed out one thing that is very evident, that no further development should be allowed on the St. Lawrence until it has been thoroughly studied from end to end. You can see the effect there, even now, of partial development. In the case of the Cedars rapids, one development might have been made taking in all the power from lake St. Francis to lake St. Louis. I am not advocating that because I have not studied it, but it should have been studied. The ice question has been accentuated at Cedars rapids because of this partial development. Their dam does not go across the entire river, the rapids are not drowned out, and they get frazil.

**Power Survey Desirable** We should have a systematic study of all our powers in Canada and of our fuels at the same time. There is no other subject that so deserves the attention of a department of the Government as this question of our fuel and power resources; and the matter should be studied in conjunction with, not only power and coal, but oil and gas and shales. We could then determine how best to get power and light for every district in the country and could formulate a policy for the handling of these resources, whether publicly or by lease to private individuals. Only in this way can we act logically. It seems to me that the course of true conservation in this connection is, first, a complete study; then, a policy; and thereafter, action.

**SENATOR EDWARDS:** I must take issue with Mr. White in respect to the requirements of power in eastern Ontario. For several years that portion of Ontario has had the opportunity of obtaining all the power needed and much more. It can be obtained right in this city, where it is lying idle and has no market. I do not think the time has arrived for the development of power on the St. Lawrence river, because there is any quantity of power in this district available for development at but a fraction of the cost. A very large amount of power on the Ottawa river can be developed much more cheaply, and transmitted to any part of eastern Ontario where it is required. In fact, I am president of a company that will

contract for three or four times the quantity of power now required. My opinion is that Canada has available ten times the water-power that it can use in the next hundred years, unless conditions change very, very materially.

There is this further point. During the period of inflation—for it was a period of inflation because there were large borrowings for the building of railways—for the twenty years prior to 1914, the development of industrial projects in Canada went far beyond the requirements of the country, and a tremendous depression was due in 1913 and 1914. It was averted because the war caused a great demand for agricultural products and for munitions. That depression will come later on, I have no doubt.

To-day munition requirements cause an abnormal demand for electrical power, but this will disappear after the war is over. Our factories then will also require much less power on account of a lessened demand for their products.

If there is a country in the world that will have to solve difficult problems after this unfortunate war is over, Canada is that country; and it behooves Canadians to study and understand the real condition of affairs. Unfortunately, Canada has lived for many years in a fool's paradise as to its natural resources. We are not possessed of the inexhaustible natural wealth that our people generally believe we have.

# Electrification of Railways

BY

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THE subject of the electrification of trunk line railways has been discussed by eminent engineers for a number of years and the advantages claimed for it, including the possible economies hoped for by the elimination of the losses characterizing the steam locomotive, have been set forth at length. It would, therefore, be somewhat of a presumption on my part to repeat the substance of such discussions without adding something new to the subject. I believe I shall be able to add such new material if, instead of attempting to give a discussion of generalities, I take up a particular electrification and show the operating results which have been accomplished on it.

An example of heavy railway electrification that is of interest to Canadians is that of the Montreal terminal of the Canadian Northern railway, the equipment of which was supplied by the Canadian General Electric Company. This electrification was installed to handle the suburban and trunk line traffic from a passenger station in Montreal to the suburban territory beyond Mount Royal, at which point the trunk line traffic will be transferred to regular steam locomotives. This electrification could be made the subject of a very interesting discussion, but the fact is that terminal conditions do not present all the problems for solution that are presented in trunk line traffic; and I believe it would be preferable to discuss the results of trunk line electrification.

This is my reason for dealing with the electrification of the Rocky Mountain and Missoula divisions of the Chicago, Milwaukee & St. Paul railway, which have been in electric operation for over a year. In particular, I wish to emphasize, what will be presented more clearly in the body of my paper, that this should not be referred to as a typical electrification, although it is, in fact, at the present time the premier railway electrification of the world.

The Western extension of the Chicago, Milwaukee & St. Paul railway is the latest transcontinental line to be completed, the company having commenced construction from the western terminus

of their lines, Bismarck, N.D., about ten years ago. The line represents not only the latest, but, in some respects, the most difficult, railway construction in the country. The grades, curves and frequent tunnels in the mountain section, and, in winter, the deep snow and excessively cold weather, present difficulties in engineering, construction and operation which it was foreseen would test the capacity of steam locomotives when handling heavy trunk line traffic. As a consequence, it was probably kept in mind from the beginning of this construction that, at least part of the line, would eventually be equipped electrically.

**Physical Condition**      The section which is now operated electrically crosses three mountain ranges, the Belt mountains, the Rockies and the Bitter Roots. There are numerous grades of 1 per cent or more, the heaviest of which is 21 miles of 2 per cent on the eastern slope of the Rockies, and the longest is 49 miles of 1 per cent on the western slope of the Belt mountains. The maximum curvature is 10 degrees, and there are numerous tunnels through the mountains, of which the longest is the St. Paul Pass tunnel, over 1½ miles in length through the ridge of the Bitter Roots.

Traffic consists of 2 all-steel passenger trains daily in each direction, the 'Olympian' and the 'Columbian,' also 4 to 6 freight trains daily in each direction. Westbound tonnage is made up of manufactured products and merchandise for the Pacific coast and foreign shipment. Eastbound tonnage includes grain, lumber, mining products and live stock. As a large portion of the traffic is through freight, the trains are made up of a miscellaneous assortment of box, flat, stock, refrigerator and other cars, varying in weight from 11 to 25 tons empty, and as high as 70 tons loaded. Since electrification, the standard weight of a freight train is approximately 2,500 tons trailing westbound, against the 2 per cent grades, and 3,000 tons trailing eastbound against the 1.6 per cent grades.

Coal in this region is expensive and requires a long haul from the mines. Water-power on the other hand is abundant and affords a very cheap source of power.

The section selected for electrification includes four engine divisions in the heaviest grade sections of the system, extending from Harlowton on the east to Avery on the west, a distance of 440 miles. This comprises 590 miles of electrically equipped single track. To get some conception of the magnitude of this electrification, it might be pointed out that 440 miles is comparable to the distance from Ottawa to St. John, N.B., on the east, or to Detroit

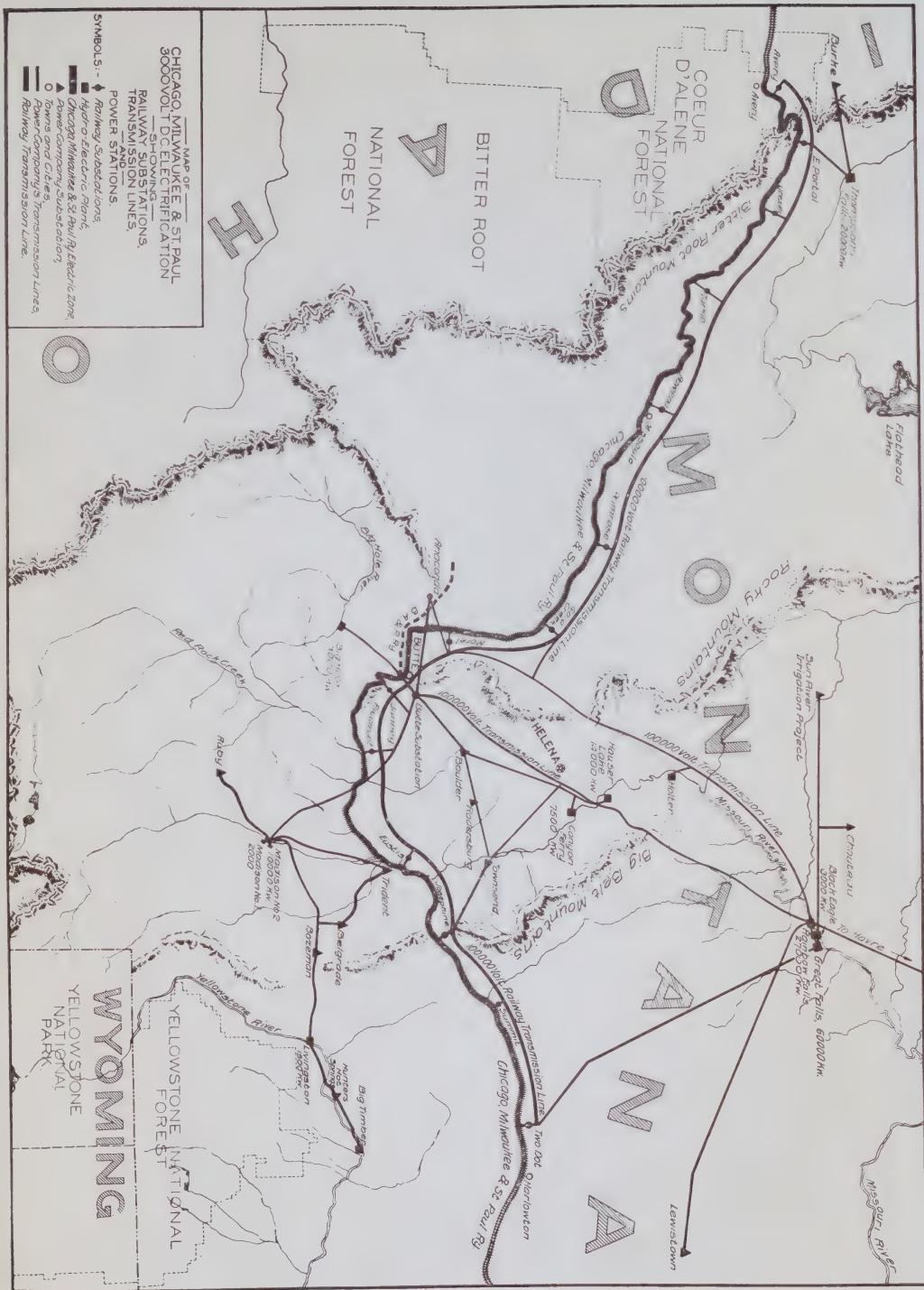
on the west, or the distance from Ottawa to New York. The extent of this electrification is not generally appreciated, but, when a proper conception of the territory covered is really understood, it can easily be seen that there is no exaggeration in making the statement that it is the greatest railway electrification in the world. At present, there is, in the United States about 1,100 miles of electrified steam railway track comprising 2,300 miles of single track. The Milwaukee electrification, therefore, constitutes about 40 per cent of this mileage.

In addition, the Chicago, Milwaukee & St. Paul has let contracts for the electrification of another section consisting of two engine divisions, 211 miles in length, extending eastward from Seattle over the Cascade mountains, to Othello. On the completion of this section, the total electrified track on the system will be about 650 miles of route, or 860 miles of single track.

The present electrified section from Harlowton to Avery was formerly operated under steam in four engine divisions of approximately 110 miles each. The first electric locomotive was put in service on the section from Three Forks to Deer Lodge, across the Rockies, on Dec. 9th, 1915, and, during 1916, the electrification was extended to the whole 440 miles. Immediately upon the commencement of electric operation these four divisions were consolidated into two divisions, one running from Harlowton to Deer Lodge, 220 miles, known as the Rocky Mountain division, the other running from Deer Lodge to Avery, 220 miles, known as the Missoula division. A locomotive run is now 220 miles where the steam locomotive run was previously 110 miles. Some train crews are changed every 110 miles, others make 220 miles on a run, depending on the speed of the train and the time they are on the road. There seems to be no particular reason why 220 miles should be the limit of an engine run except convenience in maintenance of locomotives by keeping all rolling stock on its own divisions. As a matter of fact, when necessary, a locomotive is run through with a train from one end of the electrification to the other. When one thinks of the possibility of running one engine without change over a distance comparable to that from Ottawa to New York, one realizes the tremendous advance that has been made in railway operation by electricity.

**Power Supply**      Electric power for operation of the railway is obtained from the lines of the Montana Power Co., which has a number of power plants feeding a network of high tension distribution lines throughout the state. Like many other large corporations, the Montana Power Co. has

MAP OF CHICAGO, MILWAUKEE, AND ST. PAUL RAILROAD, 3,000 V.D.C. ELECTRIFICATION, SHOWING RAILROAD  
AND POWER SYSTEMS, NEAR AND DAMED STATIONS.





been built up by the consolidation of a number of small companies. About 1898, the first of these, the Big Hole Power Co., was formed to build a 4,000 h.p. plant for furnishing power at 15,000 volts over a 22-mile line to Butte for use in smelters and around the mines. About the same time, the Canyon Ferry plant of 4,000 h.p. was developed for power transmission to the city of Helena and was, later, increased to 10,000 h.p. In 1910, the Rainbow Power development at Great falls was completed, furnishing 33,300 h.p., with a possible extension to 40,000 h.p. About 1912, these companies, together with a number of other independent power companies, were consolidated into one large company known as the Montana Power Company. In 1913, in view of the electrification of the Chicago, Milwaukee & St. Paul Ry., construction was started on an 80,000 h.p. development at Great falls on the Missouri river, and a 40,000 h.p. development at Thompson falls on the Columbia river. All these plants are tied together in one big transmission system at 100,000 volts, distributing electricity for lighting and power purposes to the various cities and industries in the state of Montana. Altogether, there are 12 hydro-electric power houses and 4 steam power houses feeding into the transmission system. It is sometimes urged against railway electrification that an accident to the power house will tie up the whole railway system, but when the railway company obtains its power from an extensive system such as this, the possibility of such an accident is reduced to a minimum. The Montana Power Co. obtains its power from the Missouri, the Yellowstone and the Columbia rivers and any accident that would shut down its transmission lines entirely would be a disaster state-wide, if not national, in importance.

Parallel to the line of the railway is a 100,000-volt transmission line which feeds power to the 14 substations along the line. As this transmission line is crossed at seven points by the lines of the Montana Power Co., power may be drawn for the railway service, at all or any of the seven crossings.

**Substations** There are 14 substations distributed along the railway, at intervals of approximately 30 miles, which transform power from 100,000 volts, three-phase, to 3,000 volts, direct current, at the trolley. The standard substation equipment consists of two 2,000-k.w. motor generator sets, each consisting of a 60-cycle, three-phase, 2,300-volt motor driving two 750-k.w., 1,500-volt generators connected in series. Three of the stations, those at Piedmont, Janney and Avery, are

equipped with three 1,500-k.w. units, and one at East Portal with three 2,000-k.w. units. This is due to the greater concentration of load at these points.

**Locomotives** The most important portion of the whole electrification is the locomotive equipment used for handling trains across this electrified zone. The standard locomotive weighs approximately 280 tons and has eight driving axles with a guiding truck at either end. This design of locomotive, and the weight and the arrangement of axles, are dictated by operating conditions. The fundamental requirement is the handling of trains weighing 2,000 to 3,000 tons, total, on grades of  $1\frac{1}{2}$  to 2 per cent. On a 2 per cent grade, this will require a tractive effort to be developed by the locomotive of approximately 150,000 lbs. Figuring on a coefficient of adhesion of 20 per cent, this means that the locomotive must have 750,000 lbs., on drivers and, in the present case, to provide due allowance for starting effort, the locomotives weigh 900,000 lbs., on drivers. Each train as described above is to be handled by two locomotives weighing approximately 450,000 lbs. each on drivers. Steam railway practice limits the weight on axles to 50,000 or 60,000 lbs. As a consequence each locomotive must be equipped with eight driving axles. For freight service each locomotive must exert this tractive effort at a speed of 15 miles per hour, which is equivalent to 3,000 h.p. The motor equipment of each locomotive must therefore be capable of developing 3,000 h.p. for considerable periods of time.

The following are the principal data applying to the freight locomotive:

|                                     |         |      |
|-------------------------------------|---------|------|
| Weight on each driving axle.....    | 56,250  | lbs. |
| Total weight on drivers.....        | 450,000 | "    |
| Weight on guiding trucks.....       | 110,000 | "    |
| Weight, total.....                  | 560,000 | "    |
| Distance between driving axles..... | 10' 6"  |      |
| Length over all.....                | 112' 0" |      |

The weights of different locomotives will vary somewhat. The weight of the passenger locomotives, which are equipped with oil-burning steam boilers and with water and oil tanks for heating passenger trains, is approximately 300 tons.

On account of the great length of the locomotive, the cab is divided into two halves with a motorman's compartment or operating room at the outer end of each half. This compartment contains the controller, air brake, gauges, valves and other apparatus requisite for handling the locomotive. The remainder of the cab is an

apparatus compartment. Through the centre of this compartment is placed in a solid bank, the rheostats, contactors and the motor generator set which drives the blower for ventilating the motors and furnishes exciting current for control. An ample aisle is left down each side of the apparatus bank for inspection of contactors and wiring. The oil-fired heater, with water and oil tanks, which furnishes steam for the heating of the passenger train is in the back end of the cab. The two cabs of each locomotive are duplicates, each equipped with apparatus similarly arranged. For very small trains the two halves of the locomotive can be uncoupled from each other and one of them used as a single-ended unit.

There are eight motors on each locomotive each geared directly to a driving axle. The motor is known as the GE-253 and is rated at 430 h.p., with a continuous rating of 375 h.p. The weight of one motor and gears is approximately 7 tons. The motor is geared with twin gears, one at each end of the armature shaft. The gear ratio is 4.55 for freight service and 2.45 for passenger service. The eight motors on a locomotive will develop at their one-hour capacity a tractive effort of 84,500 lbs., at a speed of 19 miles per hour, and at their continuous capacity, a tractive effort of 70,700 lbs., at a speed of 15.9 miles per hour. These correspond to 19 per cent and 16 per cent of the weight on drivers, respectively. With the passenger gearing, the locomotives will develop tractive efforts of approximately half of this amount at double the speeds.

The capacity of the complete locomotive is 3,440 h.p. at the one-hour rating of the motors and 3,000 h.p. at the continuous all-day rating.

In spite of the enormous capacity of the locomotives and the splendid results attained by the electrification, it will be noted that there is nothing spectacular or revolutionary in their design and construction. The same construction which has demonstrated its efficiency, simplicity and low cost of maintenance in street car service has simply been extended to steam railway conditions with corresponding increase in power of motor equipment and in strength of mechanical equipment.

It might be of interest to discuss for a moment this question of mechanical transmission in electrical locomotives. Various methods of mechanical transmission, such as combinations of side rods with, and without, gears, have been tried for electric locomotive service, particularly in Europe, where a bewildering variety of different designs has been experimented on. The *Electric Railway Journal*, in an editorial in its issue of April 21st,

1917, puts its finger on the weakness of all of these designs. The editor points out that gear losses are usually assumed at approximately 5 per cent and, as side rod losses are at least of the same amount, the side rod seems to be rather a high price to pay for the advantage to be obtained by it. The editor might well have gone further than he did. According to the A.I.E.E. standard rules, gear loss on a railway motor may be assumed at 2.5 per cent at full load of the motor. The power loss in side-rod friction is proportional to the pressure on the crank pins multiplied by the speed of rubbing and by the coefficient of friction. Reducing this to a formula, we can express the loss in tractive effort due to crank pin losses, on a single crank pin, by formula:

$$\text{Loss} = T. E. \times f \times \frac{d}{D}$$

where

T.E. = T. E. at the wheel rim

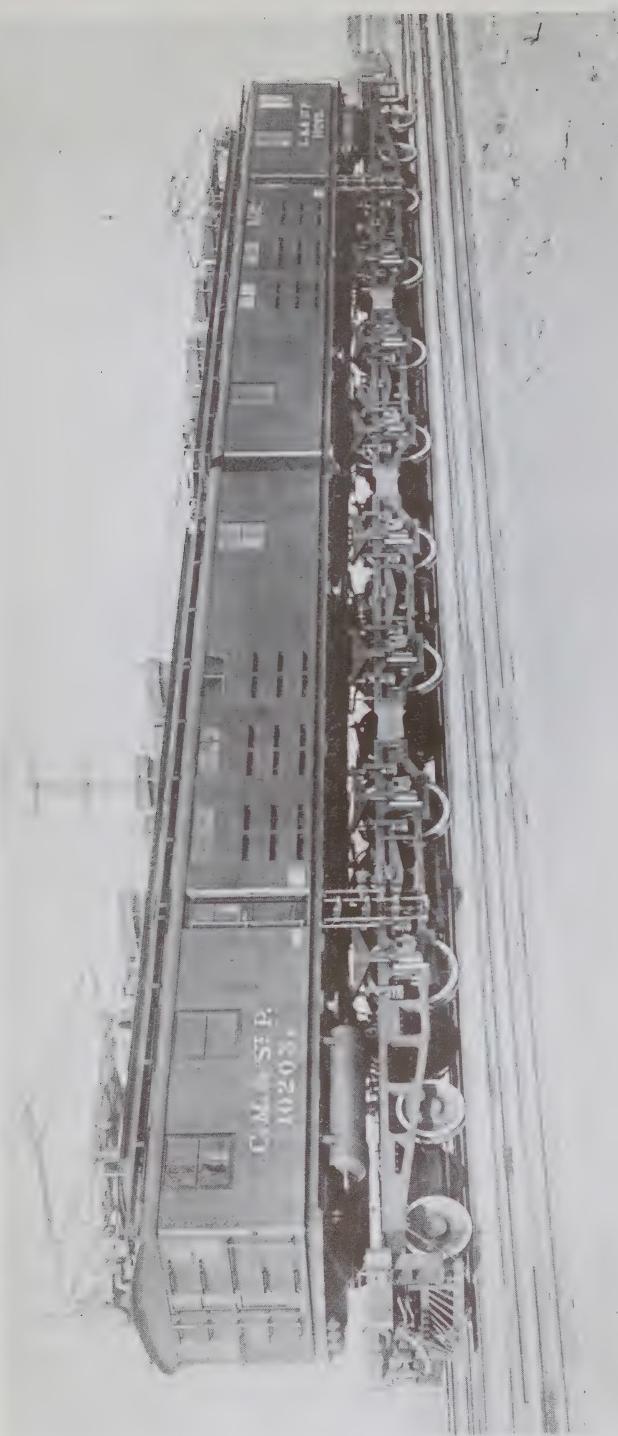
f = Coefficient of friction at the crank pin

d = Diameter of the crank pin

D = Diameter of the driving wheel

As crank pins in practice are from 6 in. to 9 in. in diameter, while coefficients of friction of lubricated surfaces are from 3 per cent to 6 per cent, it is an easy matter to calculate the loss in a single crank. Since, on every side rod there are at least two crank pins, one on each end, while in many designs of side-rod locomotives, such as those employing jackshafts, there are several such cranks in series and, remembering that to these must be added the friction losses in jackshaft bearings and the additional losses in armature bearings produced by side-rod pressure, it is easy to see that the side-rod losses often amount to a very serious item. In these days, when an engineer buying a turbine figures closely the efficiency and steam consumption of his turbine and capitalizes the losses in order to determine what he can pay for every 1 per cent in efficiency, we are justified in eliminating every loss in efficiency due to complicated methods of transmission and in gearing our motors directly to the axle.

Maintenance of equipment is another item which enters seriously into consideration. Unquestionably the most economical design of locomotive from the maintenance standpoint is the locomotive without gears or with motors geared directly to the axle. Referring to the Interstate Commerce Commission's report, we



THE KING OF THE RAILS  
A 3,000-volt electric locomotive on the Chicago, Milwaukee and St. Paul railroad.



find the following among the records of cost of maintenance of electric locomotives:

|                           |      |       |                |
|---------------------------|------|-------|----------------|
| Butte, Anaconda & Pacific | 1915 | 3.9c  | per loco. mile |
| " " "                     | 1916 | 4.02c | " " "          |
| New York Central.....     | 1915 | 3.28c | " " "          |
| " " "                     | 1916 | 2.89c | " " "          |
| Baltimore & Ohio.....     | 1914 | 4.9c  | " " "          |

These costs of maintenance present one of the great arguments for the use of electric rather than steam locomotives, and such costs as I have quoted are not duplicated by any type of locomotive employing more complicated methods of transmission.

As compared with this, the cost of maintenance of a steam locomotive will run from 10c. to 20c. per locomotive mile, depending on the capacity of the locomotive and its service.

**Regenerative Control**      The locomotive is equipped with regenerative control; that is, the control system is so arranged that, when the train is going down grade, the driving motors can be used to retard the train by acting as generators and converting the energy of the train into electric energy which is returned to the trolley line. This regenerated energy may be returned to another train ascending the grade in the same section or, if there is no such train, it will be retransformed through the substations and delivered to the transmission line for general power purposes. A 3,000-ton train going down a 2 per cent grade may represent a kinetic energy of 3,500 h.p. and, if only a fraction of that amount can be recovered electrically, it may represent an economy that is well worth considering.

This regeneration is obtained by exciting the fields of the motors during braking to such an extent that the counter electro-motive force builds up higher than the line voltage and returns the current to the line. The control is so arranged that the equipment can drift over from motoring to braking by simply changing the position of the proper controller handles. That is, if a train running on the level approaches a curve, tunnel or other obstruction for which the engineer wishes to slow down, he can change his equipment from motoring to braking, gather up the train as he approaches the obstruction and then let out his train to full speed after he has passed the danger point. In the meantime, the power of the train has not been wasted by brakes but has been returned economically to the trolley line.

It has long been known that on a three-phase system the motors automatically act as a regenerative brake but at a constant

speed. With a three-phase system, as soon as the train speed exceeds the speed of synchronism, the motors automatically return power to the line, but, by the series direct current motor and the regenerative system which has been installed on the Chicago, Milwaukee & St. Paul, it is possible to return power to the line through a wide range of speed.

A marked advantage of electric braking is that it is not subject to the alternating variations of speed which are produced by air braking, due to the leaking off of pressure and recharging of auxiliaries. In addition to this, the wear of brake shoes is eliminated, which amounts to a serious item when heavy trains are to be handled on long grades. The disasters which are sometimes due to overheating of brake shoes or brakeheads on such grades are also avoided by the use of electric braking. The electric braking takes place entirely at the front end of the train, the train is held steadily bunched up against the engine, and, at the same time, the air reservoirs are fully charged and the air brakes are held in reserve for an emergency.

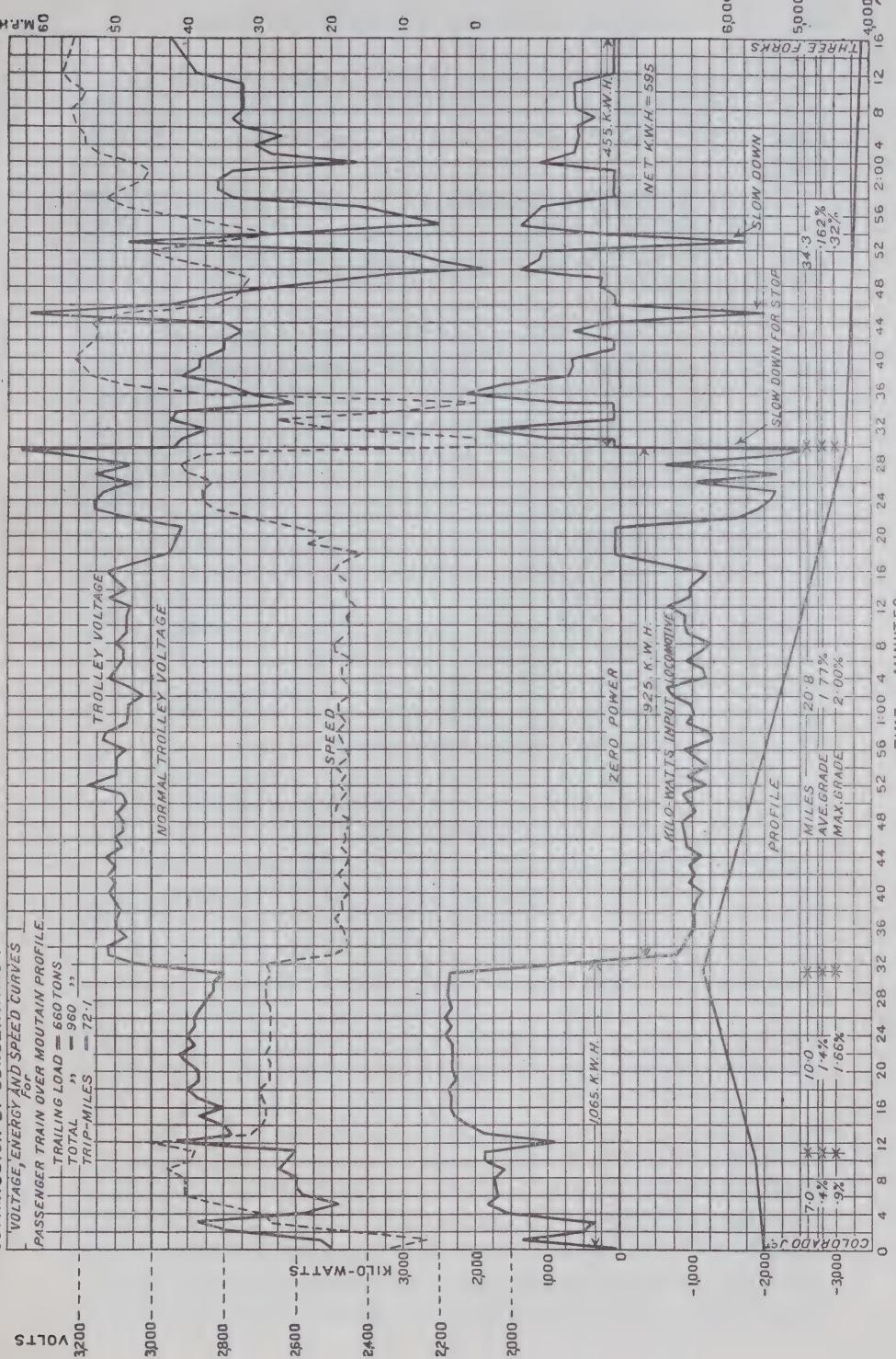
The amount of power returned to the trolley by regeneration varies with the amount of the grade and the type of train. On specific tests, it has been shown that a train on a 2 per cent grade has regenerated 42.8 per cent of the power required to pull the same train up the grade. On the 1.66 per cent grade, 23.1 per cent has been regenerated. The records for the month of November, 1916, over the entire Rocky Mountain division for both freight and passenger trains show that the regeneration was equivalent to 11.3 per cent of the total power used at the motors.

Possibly the clearest idea of the electric operation of this system is to be obtained by study of the speed energy curves of a locomotive and train in operation. Such a set of curves is shown in one of the figures. This represents the record made by a train of 960 tons over a run of 72 miles up grade and down grade.

The lowest curve in the figure shows the profile of the track, the distances and gradients encountered. The next curve above shows the power input, or output, of the locomotive. Going up the grade of 1.4 per cent the locomotive draws approximately 2,400 k.w. from the trolley. As it goes over the peak of the grade the power drops to zero and reverses, and from this point, going down the grade, the curve indicates that the locomotive is pumping approximately 1,000 k.w. back into the trolley. When it reaches the level, the power swings from 2,000 k.w. positive in accelerating the train to approximately 2,500 k.w. negative in slowing down for stops.

COMMISSION OF CONSERVATION

VOLTAGE, ENERGY AND SPEED CURVES  
FOR  
PASSENGER TRAIN OVER MOUNTAIN PROFILE  
TRAILING LOAD = 660 TONS



VOLTAGE, ENERGY AND SPEED CURVES FOR PASSENGER TRAIN OVER CONTINENTAL DIVIDE, MILWAUKEE AND ST. PAUL RAILROAD

The speed as shown on the next curve is approximately constant at 18 miles per hour when going down the grade and rises as high as 50 miles per hour for spurts when running free on the level sections.

The trolley voltage shown on the next curve is normal at 3,000 volts and drops to 2,900 volts when taking power from the line, rising to 3,100 volts when the train going down grade is delivering power to the line.

**Operation** The results of operation have been all that were anticipated. The schedule speed of trains has been materially increased. For example, on the 20 miles of 2 per cent grade the running time of passenger trains can be reduced from 65 minutes, under steam, to approximately 40 minutes, with electrical operation. On the run from Deer Lodge to Butte, which, with a steam locomotive, required one hour and 20 minutes, a saving of 30 minutes can be made. In freight service, it has been found that, where the steam locomotives have required 10 to 12 hours to make 110 miles, electric locomotives can meet a schedule of 7 to 8 hours for the same distance. The serious delays which were often encountered in the winter time due to snow and low temperatures have been eliminated, as the electric locomotives are not delayed by excessively cold weather or by inability to obtain fuel and water in case of snow blockades.

The winter of 1914-15 was exceptionally severe in the Rocky Mountain division. Temperatures of 40 degrees below zero and heavy snow storms interfered seriously with the operation of steam locomotives and the electric locomotive had many opportunities to demonstrate its abilities and its superiority over the steam locomotive in such weather. Frequently, when a train was stalled and its steam locomotive was frozen and dead in the drifts, the electric was sent out to bring it in and to clear the tracks.

It is too early to speak very conclusively as to operating costs. We hope in a short time to have definite records of the cost of operation and its relation to similar costs prior to electrification.

The records on the Butte, Anaconda & Pacific show that the cost of maintenance of locomotives was reduced from 13.45c. per locomotive mile in the last six months of 1913, under steam operation, to 4.5c. in the corresponding months of 1914. We expect a similar reduction will be shown on the Chicago, Milwaukee & St. Paul.

From the records of power used upon the Rocky Mountain division, we can compare the amount of coal used in the last three months of 1915 with the amount of electric power used in the

corresponding months of 1916. In 1915, the coal used on the Rocky Mountain division alone was 50,310 tons. In 1916, under electric power, a movement of the same tonnage required 17,821,000 kilowatt hours. In general, from the records of both the Butte, Anaconda & Pacific and the Chicago, Milwaukee & St. Paul, it appears that 1 k.w.h. of electric power will do approximately the same work in handling tonnage that 6 to 7 lbs. of coal will do upon the tender of a steam locomotive. To make this comparison more concrete, I may say that the records of the last three months of 1916 on the Rocky Mountain division showed a power consumption of 39.4 k.w.h. per 1,000 ton-miles, or that 1 k.w.h. delivered at the substation will handle 25.5 ton-miles. In 1915, under steam operation, 276 lbs. of coal were required per 1,000 ton-miles. In other words, a movement of the same amount (25.5 ton-miles) will require 7 lbs. of coal. If electric operation had depended on a steam-driven station instead of a hydro-electric station, the coal consumption would have been approximately half of this amount, or  $3\frac{1}{2}$  lbs. of coal, for a movement of 25.5 ton-miles. To put the same statement in terms of dollars and cents, it indicates that, by electrification of a trunk line railway, the cost of coal for operation of trains can be cut in two if electric power is produced from a steam-driven station. On the other hand, if electric power is produced from a hydro-electric station, the cost of power can be estimated on the basis of the unit costs of coal and electric power, keeping in mind the fact that 1 k.w.h. of electric power will do about the same amount of work that 7 lbs. of coal will on the steam locomotive.

The mountain sections have long been the limiting feature in the operation of the Chicago, Milwaukee & St. Paul railway, and perhaps the most emphatic conclusion which I can give to this paper is a quotation from a recent article by Mr. C. A. Goodnow, in charge of their electrification, in which he says, "Electrification has been such a tremendous success on the Milwaukee road that it is difficult to state the results without seeming exaggeration, but I think it quite within the fact to say that the Milwaukee road has forgotten that the Continental Divide exists."

#### THE KING OF THE RAILS

The paper was concluded by showing a moving picture film that represented the story of the development of transportation.

Beginning with the earliest method of transportation it showed the Indian pack trains through the forests, after which came the settler clearing the forest and skidding on stone sleds and logs and

boulders. The ox and horse showed a still further development in methods of transportation. Then came the steam locomotive, the 'De Witt Clinton' and train on the Hudson & Mohawk railway, followed later by the powerful steam locomotives of the present day. In the meantime, city transportation beginning with the horse-car had been followed by electric surface cars and heavy trains of elevated and subway expresses. Finally, came the application of electricity to heavy trunk line operation. Pictures were shown of the locomotive shops of the General Electric Company at Erie, Pa., where the Chicago, Milwaukee & St. Paul locomotives were built. The details of building and assembling the locomotive were also included. Finally, the completed electric locomotive was shown coupling up to a train at the beginning of the electrified division. Then followed a trip across the Rocky mountains, showing views from the train and also passing trains, both freight and passenger, pulled by electric locomotives. The latest form of transportation illustrated by this mighty modern engine gives the film its name, 'The King of the Rails.'

#### DISCUSSION

SIR JOHN KENNEDY: I am glad to be here, and to learn from the reading of Mr. S. T. Dodd's excellent paper, and the illustrations with which it is accompanied, how satisfactorily the electrification of railways is proceeding, and the conditions under which it can be most successfully carried out, especially as regards main line transportation. Incidentally, too, it is shown how progress is retarded and kept within safe limits by cautious conservatism, and the very heavy expense of installation. Where the method of production and use of transportation power is so radically different as it is between a steam engine running on rails and a water-power in the mountains, the progress must be gradual to be safe, and the field limited. In the early days of bridge building, for instance, it was safe to enlarge step by step 10, 20 or 30 per cent at a time, but it is a wholly different thing to multiply several times up to the Quebec bridge. Looked at in this light, the electrification of railways is really proceeding rapidly and satisfactorily, and its field of application is being definitely ascertained.

I again express my thanks to the author for presenting a paper which so happily combines the popularly interesting and the scientifically sound and informative.

MR. R. A. ROSS: I do not think I have any remarks to make except to express wonder at what has been done. One point which Mr. Dodd has not emphasized is that the limitation to the extension

A Question  
of Cost

of this system of electrification is purely economic. The physical equipment is commercial to-day and electric traction could be extended over all our lines in Canada if the cost were not too great. Whether electric haulage can be used depends very largely on the density of traffic. You will find that electric locomotives are used to-day where conditions are favourable, such, for instance, as in New York where the density of traffic is high and they wish to keep down smoke, etc., or on mountain sections where the haulage is heavy. In both those cases the economics can be worked out. But, on longer, straight hauls where trains are few, the cost for power stations, overhead equipment, etc., is very high; so that, even though your platform labour is the same, and you pay less for power, you have to consider the heavy capital cost and charges for equipment.

At the same time, the electrification of the Chicago, Milwaukee & St. Paul railway marks a great step in advance. Four hundred and forty miles of continuous road, much of it mountain section, operating in a satisfactory way and regenerating its power so beautifully as it does on those grades, with the wonderful improvement in operation under winter conditions where there is no water to freeze or water tanks to take care of, forms an object lesson indeed. There are many phases of this subject and many possible economies and advantages, upon which Mr. Dodd has not touched.

A MEMBER OF THE COMMISSION: Does the cold affect the electric locomotive?

MR. DODD: No. The cold in winter, of course, greatly lowers the steaming power of the steam locomotive. If a steam locomotive is stalled in a storm, there is a possibility that valves and piping may freeze up, but there is no danger of this in the electric locomotive.

MR. SNOWBALL: What is the comparative cost of steam and electricity for railway traction?

MR. DODD: It depends upon the price paid for coal and for electric power. It is rather difficult to make a definite estimate because we must include not only the price paid for coal but the cost of transportation and the expense of operating coal chutes, ash dumps and other expenses involved in the handling of coal. Possibly \$4 per ton might represent a fair figure for the total expense due to coal, while electric power in large quantities might cost in the neighbourhood of  $\frac{1}{2}$ c per k.w.h. During the last three months of 1915, approximately 50,000 tons of coal was used on the Rocky Mountain division, whereas the electric power for the corresponding three months of 1916 was 17,800,000 k.w.h. On the basis of costs

suggested above, this would mean approximately \$200,000 for coal as compared with approximately \$88,000 for electricity. These figures may not be correct for the Milwaukee road but they give an idea of the order of difference. In some parts of the country electric power would cost more and coal would cost less.

There are the same number of men on an electric locomotive as on the steam locomotive. The labour men insist on the force not being reduced. Moreover, with a locomotive at the head of a 2,000-ton train, it is a good thing to have a second man, if he does nothing but wander through the locomotive and see that all the machinery is in good condition.

There has been no change in the rate of pay, but many men have applied for transfer from steam to electric locomotives.

MR. SNOWBALL: When the saving is as eighty-eight to two hundred on motive power and as eight to eighteen in equipment and maintenance, why has the Milwaukee road not electrified a greater mileage.

MR. DODD: Four hundred and forty miles of road is a pretty long section. It is the first big electrification that has been made. The company has now let contracts for the electrification of 220 miles of road through the Cascade mountains, leaving a gap of about 200 miles between the two electrified sections. It will, I have no doubt, finally electrify the connecting section. It costs money to change from steam to electricity and at the present time the railways experience great difficulty in raising capital. With this long section of the Chicago, Milwaukee & St. Paul in operation, I do not think that question will have to be asked very much longer.

#### RAILWAY ELECTRIFICATION IN CANADA

Mr. W. F. Tye, C.E., Montreal, late Chief Engineer of the Canadian Pacific railway, was invited to address the Commission on the electrification of railways in Canada, but was forced to decline as he felt that the short time available debarred him preparing an adequate address on this important question. Mr. Tye's letter of declination, however, is such an admirable, though brief, summing up of the subject that it has been printed below:

"The question is a very important one, and very complicated. It is not now so much a problem in mechanical or electrical engineering as one in economics. The ordinary man who has seen the miracle wrought by the application of electricity to industrial plants, imagines that the same result can be obtained by its application to the railways. It must not be forgotten, however, that

the miracle has been brought about by the tremendous improvement in, and the reduction in, the cost of transmission of power, rather than in the reduction in cost of its production.

"If the industrial plants could be located immediately at the power site, or at the pit mouth, the cost of transforming the power into electric energy would be saved. All plants cannot, however, be so located, and even in the limits of one shop, it is more advantageous and economical to transmit the power electrically than by shafts, pulleys and belts. In the steam locomotive, the power is produced immediately at the point at which it is to be used, so that the advantages of easy and cheap transmission are, in a great measure, lost.

**Advantages of Electric Locomotive** "After this is said there still remain many decided advantages which the electric has over the steam locomotive. Therefore, there are many decided economic reasons for the adoption of electric traction on our railways, just as there are many and decided reasons against its adoption.

"Some of the reasons in favour of its adoption are quite evident. Coal in all the great central area of Canada is entirely lacking; water-powers are abundant, and, even under equal conditions, hydro-electric power is cheaper than steam.

"The cost of maintenance of the electric is only a fraction of that of the steam locomotive. The steam locomotive requires hours in the round-house after a long run before it can be again fit for road service, whereas the electric can be sent out again almost immediately after its arrival. The road can thus be operated with fewer units. Electric locomotives can be so connected that they may be operated in pairs under one crew without any loss of power; steam locomotives can not.

"On long ascending grades the electric locomotive with the strength of the power house at its back, retains its full power and freshness to the very summit. The steam locomotive can not. On long descending grades, the electric motor can return to the power line, power derived from the train's momentum. All this is lost in the case of the steam locomotive. As far as operating expenses due to power are concerned, the electric locomotive has every advantage, and is capable of effecting many and decided savings.

**Advantages of Steam Locomotive** As far as capital charges and maintenance of roadway are concerned, the advantages are all with the steam locomotive. The cost of electric installation is heavy; therefore, the fixed charges are materially greater.

"On a large portion of the railway mileage in Canada, it would be necessary to develop new water-powers without any market other than the railway. The railway load fluctuates not only from month to month, but from hour to hour. It is almost a certainty that the power development would require to be three or four times as great as the average load; hence, comparatively expensive power. The maintenance of the roadway is materially

increased, the danger from snow, especially in the mountains, where electric traction would be peculiarly advantageous, is much increased. The troubles arising from the failure of any part of the electric installation are widespread, and much more disastrous than the failure of a steam locomotive.

**Operating and Fixed Charges** "Balancing the pros and cons, it is found that electric traction materially reduces the operating expenses, but materially increases the fixed charges.

The saving in operating expenses is nearly directly in proportion to the number of trains per day: the greater the density of traffic, the greater the saving. The cost of installation is in a great measure independent of the density of the traffic, or the number of trains per day. On a road of a given standard, the cost of many of the items which go to make up the whole, is the same, whether the trains be few or many. The problem thus always resolves itself into this: With the number of trains per day on a given section of a road, will the undoubted savings and operating expenses be sufficient to offset the undoubted increase in fixed charges? Every division of the road is a separate and independent problem.

"Canada is a very large and sparsely settled country, with a greater railway mileage per capita than any other country in the world, hence the traffic per mile is very thin. The Canadian Pacific, I understand, has not, as yet, found a place where the traffic is sufficiently dense to justify the cost of installation of electric traction.

"Coal has increased greatly in cost and is difficult to obtain at any price. The scarcity is only temporary, but part, at least, of the increased cost is sure to be permanent. As labour and all supplies have increased in price, the operating expenses have risen rapidly. Therefore, from an operating point of view, electric traction has become more desirable. This is largely offset by the increased cost of money, making the fixed charges due to an electric installation decidedly greater. No road in Canada, excepting the Canadian Pacific, is in a position financially to contemplate large capital expenditures.

"You will thus see that the question is highly complicated, and one on which it would be impossible to prepare a discussion of any permanent value in the time available. Will you, therefore, kindly thank Sir Clifford for the honour he has done me, and tell him I am only declining because I do not believe I could prepare an address of any permanent value in the time at my disposal."

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## A Note on the Canadian 'Pactolus'

BY

MONSEIGNEUR CHARLES P. CHOQUETTE

*Professor, Seminary of St. Hyacinthe*

I HAVE listened with pleasure and interest to the technical exposition of the St. Lawrence power question, which is also the subject of my paper relating to a Canadian Pactolus. I will not repeat the figures and calculations of these able engineers, but allow me, gentlemen, to present, as a sequel, the consideration of an *ingénieur en chambre*, that is, of a professor who is more familiar, I confess, with theory, than with practice.

In prose and verse, the ancient poets have sung, under the name of Pactolus, a small river of the old world, which, they claimed, carried shining scales of gold. Imagine the lyric accents of the same writers if they had seen an immense river which carries not scales only, but waves of gold, and yet such is truly the richness, under the form of available mechanical energy, of the St. Lawrence river. Think of cities like London, New York, Paris, Chicago, having at their very door a veritable Niagara, and yet such is the situation of the metropolis of Canada.

If you wish to give the idea of an indefinite amount of power, you will probably mention Niagara falls, with its millions of potential horse-power, according to optimists. But did you ever consider this very point: that the volume of the St. Lawrence river is larger than that of the Niagara river and, what is not generally known, the total fall in the St. Lawrence river is greater than that at the falls of Niagara. The Lachine canal has a drop of 45 feet, the Soulanges canal, 85 feet, the Cornwall canal, 48 feet. That represents altogether, in the 80 miles run from Lachine to Cornwall, a head of water of 178 feet, whereas Niagara falls is some 160 feet high.

If it be assumed that it requires about two pounds of coal per hour to produce a horse-power, you can, with pencil and paper, easily compute that the equivalent of some sixty thousand tons of coal is dissipated every day in the roaring of the St. Lawrence river.

Heretofore, coal has been the potent factor in all industrial progress. The country that has no coal is a weak country; it has

to rely on the good-will of other countries. In this respect, both Ontario and Quebec are deficient. There is no coal in these provinces and there is no hope of finding any, at least in Quebec. And why so? Because, in spite of being components of the New World, Quebec and Ontario geologically belong to the oldest worlds.

You know that coal is fossil wood. When the coal fields of New Brunswick and Nova Scotia were in process of formation, these provinces were often under water, and sediment of all kinds, especially that from drifted wood, was deposited. And whence came this drifted wood? Probably, it came from Quebec and part of Ontario, which were then, with the Adirondack mountains, the only places, in both Americas, on which forests could grow. You see that this vital question of the exportation of wood is an old one. Hundreds and hundreds of thousands of years ago, when animal life was seen in shells and fishes only, when there were no lumber kings, no exportation duty, wood was exported on an immense scale, and the result is that our primitive forests now lie in black, carefully-laid strata for the benefit of our sister provinces. And you have to redeem them, pay for them, and take them back with immense trouble and expense.

I confess that this explanation is not absolutely orthodox according to geology, but there is enough truth in it to serve my purpose.

Good Providence dispenses her favours to good people. It is true that in the distribution of her gifts to mortals, we, bad people from Ontario and Quebec, have not received a lump of coal, but, as if in compensation, we have been favoured with more than the equivalent in numerous and powerful water-powers. To turn these powers to a useful purpose is a noble work, and it is the duty of an intelligent people to strive to do this.

Many water-powers are now utilized for light and power. Several of these you probably know, and undoubtedly you know the one, a spark of the energy of which is seen in the light bulbs in your house. I hear that there is everywhere an abundance of light—of physical light, I mean!—the supply exceeds the demand. As for power proper, more and more is required every day from electrical sources.

But let us also consider water-powers as a source of heating for our houses in place of coal. It is in this respect that the St. Lawrence river with its unlimited amount of energy, deserves the name of Pactolus.

Take as an illustration the city of Montreal. That city with her present population, buys, I estimate, 500,000 tons of coal for

domestic heating annually, at the enormous price to-day of at least \$5,000,000, and of \$3,000,000 to \$4,000,000 in normal times. What a bonanza for a firm to have, for only a portion of its product, customers who paid it \$3,000,000 or \$4,000,000 annually, especially if you consider that the cost and maintenance of a plant to supply these customers—a 333,333 kilowatt plant in this case—would cost less than \$100 for a kilowatt. Whilst a kilowatt-hour would cost only one-sixth of a cent, it would sell for \$15 yearly.

As the kilowatt-hour, counting on an efficiency of 95 to 100 per cent, gives about 3,500 B.T.U., the consumer would receive, for the same amount of money, almost as much heat as he could get from the coal he usually buys and burns in stoves and furnaces having an efficiency of only 40 to 60 per cent. From this, I may be allowed to conclude that the use of water-powers for heating purposes is not a dream nor a mirage. I really think that the next generation will enjoy this luxury. It is then the part of wisdom to have an eye, a constant and jealous eye, upon our Canadian Pactolus. It represents, I repeat, a fabulous wealth, an enduring wealth, as perpetual as the sun that causes it.

I would suggest, with due respect, that the Government should guard this heritage jealously as a national asset. Governments have adopted a very laudable policy of permitting the cutting of forests only according to definite plans making for conservation. Is it not possible to follow the same line of policy in utilizing the power of the St. Lawrence river? Such a policy would prevent the uneconomic development of power that is now going on and it would also prevent wasteful rivalry which may occur between conflicting interests and cause heavy losses to both capitalist and consumer.

My idea would be to have the development of the power carried out by a government commission according to a well thought out plan in which utility and beauty would be combined. Under such an arrangement, I see no objection to damming the St. Lawrence river. Indeed, I add, without hesitation, that I long to see such an achievement.

Now, the first material thing required for this great work is, of course, money. I take it for granted that engineers foresee no insuperable difficulties in the work itself and in protecting the interests of navigation. In like manner, the capitalists will probably say that the raising of money is not a task of overwhelming magnitude. This last affirmation, I suppose, takes for granted that there is money in Canada, and that there will be much more of it at the victorious conclusion of the war. So far, so good, but

the same affirmation may also presuppose that there is an unlimited amount of money on the other side of our frontier and that this money is available at will.

At this permit me to demur. Viewing the matter philosophically, let me remark that the more European money may be desirable, the more the American money might be insidious. Nothing is more dangerous to a small farmer than a big neighbour, always amiable and gracious, always ready to offer mortgage loans.

The Americans possess a fraction of our large river. For some people, you know, the fraction of a unit is often as large as the unit itself. I have the highest consideration for the intelligence, the industrial perspicacity and the honesty of our big neighbour, but I cannot refrain from exclaiming with the priest of Neptune in times of old: *Timeo Danaos et dona ferentes*: I fear the Greeks even bearing gifts. 'Beware of the wooden horse', the Trojans were told, and I say to my countrymen, beware of the American octopus. Her tentacles are numerous and far-reaching. They ensnare, they stupify, they paralyze. Their influence will change the point of view of our people; it may destroy even our national soul. The owners of the public wealth of a nation are sooner or later the masters of her destiny.

There is another class—and very respectable men they are—whose voices will be surely heard when the time actually comes to proceed with the work of development. The poets and the artists, I mean, will probably present the strongest opposition. These worthy men are not capitalists, they are far from it, but they are rich in all the beauties of Nature. The sun, the flowers, the winds, the rivers and the torrents are their possessions. They enjoy these as if they were their owners. They adore them. Woe to the man who would lay a profane hand on these objects of their cult, and turn them to the abject control of industry. I respect these men, but I must ask them to remember that there are many kinds of beauties in nature.

I have learned that beauty is equivalent to order: to order, the result of design. According to a definition that I have found in my inkstand, I say that beauty is everything that creates in an honest and cultured man a sudden elevation of his mind, a surprise full of respect. Taking this point of view, I affirm that destructive transformations may produce beauty, that ruins even have beauty. When the traveller walks in the Roman Forum, he feels an enjoyment which he will never forget, and for him, the Arch of Titus and the Coliseum are beautiful even in their ruins.

The same holds true as regards the natural beauties of the St. Lawrence. I can easily imagine how all men, poor or rich, learned or ignorant, poets or peasants, will rejoice at the sight of a titanic wall connecting the two sides of the great river, and that they will take an infinite pleasure in putting a safe foot on what was formerly the moving crest of treacherous whirlpools. In order to resolve many other abstract considerations, let me illustrate my thought by a very concrete as well as convincing illustration, showing that the violation of nature may be, in its own way, a beauty. There was probably, some years ago, either on the shore of lake Superior or on the coasts of Cape Breton, a small farmer whose house was on the top of a green little hill. A fresh brooklet ran gaily under bushes; flowers were everywhere. In fact, the whole scene was most beautiful, and inspired poetry and happiness. But prospectors came and found that the sub-soil of the hill contained a rich deposit of iron ore. Immediately, a lot of miners arrived with their rough instruments. The house was torn down, the hill opened up, the rusty substance taken out was melted and refined in blast furnaces and fabricated into numerous forms. It produced bolts, beams, trusses; it produced what is seen now in that wonder of science and industry, the Quebec bridge. And so it happened that a bit of nature's beauty was turned into a marvel of human accomplishment. I hope that another marvel of human accomplishment will be the damming of the mighty St. Lawrence with its tremendous pent-up energy.

SIR CLIFFORD SIFTON: It is sometimes said that our discussions are strictly and severely utilitarian, occasionally even to the point of dullness. We are indebted to Mons. Choquette for having presented his ideas to us in novel and entertaining language, and he has certainly removed from the discussion any suspicion of dullness.

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# The Conservation of Wild Life in Canada in 1917: A Review

BY

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IN considering the natural resources with which we have to deal, it will be found that our wild life, as our native mammals and birds are collectively termed, offers some of the most complex problems. The existence of certain of our resources is, to a large extent, not affected by the activities of man that necessarily follow the opening up and development of the country. Our water-powers, for example, are not affected by the extension of agriculture. Barring forest fires, insect depredations and disease, and excessive lumbering operations, our forests should persist; and where they are cut down they may be artificially replaced. But it is not so with our wild life. Most sensitive in its response, the finely adjusted natural balance of animal life is upset by man's intrusion. He occupies their former natural haunts and drives them farther afield and in reduced numbers. With the advent of the breech-loader and the high-power rifle, the greatest enemies to all wild life, their numbers became reduced to the point where extermination is merely a matter of a comparatively few years. And it cannot be too often repeated that once any of our native animals are exterminated, they cannot be brought back or replaced; that is the outstanding characteristic of the wild life of any country. In the struggle for existence that is constantly being waged between all forms of animal life, including man, the stronger prevails and the weaker goes to the wall. While the artificial weapons of offense that man's intelligence has furnished make him all the more powerful and destructive an adversary, that same intelligence should enable him to appreciate the limits to which his destructive proclivities may be carried with safety.

In the case of no other natural resource is the application of the real idea of conservation, use without abuse, more necessary than in the case of our wild life. This product of nature's undisturbed dominion over forest and plain simply melts away into nothing more than a memory of regret when it meets the unrestrained

destructive tendencies of 'nature's insurgent son' intensified by all his superior power of offense. Setting aside all claims based on æsthetic and scientific grounds, impelling as such claims are, we cannot, as a country responsible to posterity for the handing on of our resources as unimpaired as possible, afford to neglect the great opportunity which the existence of so unique a wealth of wild life, a wealth unsurpassed in its economic value elsewhere in the world, furnishes to improve our natural prosperity and the efficiency of our people.

In selecting a subject for my address, I felt that a very useful purpose would be served if the events of the year were reviewed so that, by the measure of our accomplishment and the recital of our further needs, we might be encouraged to continue without relaxation our efforts on behalf of our wild life and of those who depend upon its continued existence.

**Vigorous Policy  
is Essential** With the combined intelligence and energy of the great nations of the world centred on the task of devising and putting into effect means of destroying life on one hand and of sustaining it on the other, we may be asked whether consideration of the welfare of our wild life is warranted at the present time. Without exception those who have given the subject the closest study and are most imbued with its wide significance will give a most emphatic reply: the need was never greater and the results of neglect never more fraught with serious consequences.

**Fur Resources  
of the  
North** In the paper that you invited me to contribute to your last annual report, I endeavoured to emphasize the importance of our fur resources of the north and the need of measures to prevent their unrestricted exploitation. The fur-bearing animals, particularly beaver, first of all our natural resources attracted hardy men to our shores and forests. To-day in that great unsettled region of northern Canada they still constitute the sole attraction and means of support to thousands of our inhabitants, white men and natives, and produce an annual crop of furs which in the census of 1910 was valued at \$1,927,550, but which estimate, I feel, does not give the full appraisal. To-day the annual fur crop will be worth considerably more. The fur-bearing animals therefore, contribute no insignificant share to the country's export trade of natural products, on which trade the future of this country will largely depend. It is safe to say that the chief and most widely distributed natural product of the major portion of Canada to-day is fur. Also, it may be confidently asserted that with adequate conservation and

barring catastrophes beyond human control, our northern fur-bearing animals will continue to render productive those non-agricultural areas they inhabit and to support the population native to them. The maintenance of the country's productiveness in all directions is pre-eminently important at the present time of vast expenditures and increasing national debt.

Nor should it be necessary again to remind you that, besides affording the main supply of exportable goods, the wild life of the north constitutes the main and, in most cases, the only food supply for the inhabitants of our northern territories.

The Farmers' Allies      Turning for a moment to an important part of our wild life, namely, the insectivorous birds, sufficient,

I hope, has been said on previous occasions to emphasize the important relation that these birds play in protecting our crops from destruction by their innumerable insect enemies. Never in the history of the world has the necessity of protecting our food crops from destruction been more urgent; never has the need of taking every means to protect and encourage these allies of ours in increased crop production had a greater claim to our consideration. Expressed in terms of wheat, the value of the field crops destroyed annually in Canada by insect pests, is sufficient to feed our entire population for a year. We must, therefore, protect our greatest natural allies in crop production.

Finally, it is the duty of those of us who are 'carrying on' at home to see to it that, when the liberty of democratic peoples is established and those who have been spared return to resume the arts of peace, there is preserved for their enjoyment, that part of our wild life that counts for so much in maintaining that spirit of the love of nature and of resourcefulness and self-reliance that is characteristic of the true naturalist and sportsman. As one of our leading ornithologists and sportsmen wrote to me from France, where he is now, in charge of a sniping school: "If you knew what is happening around me as I write this, you would be surprised that I could think of such a thing as game protection, but, if I ever return I want some of my old life to return to, as do many others here."

Without any exaggeration it may be claimed, I think, that the past year has been the most notable in the history of the wild life conservation movement in this country. In spite of the pressing demands upon Parliament made necessary by our war activities, two measures of vital importance to the conservation of our wild life were passed, namely, the Migratory Birds Convention Act and the Northwest Game Act. No legislation has ever been

placed on the statute books of the Dominion that had greater possibilities for useful service in the direction of conserving the wild life of the country. The value of this legislation was enhanced by the third act on the part of the government, namely, the creation by order in council of an Advisory Board on Wild Life, the work of which will now be reviewed as briefly as possible.

#### ADVISORY BOARD ON WILD LIFE PROTECTION

Realizing the desirability of co-ordinating the efforts and opinions of those officers of the various Departments concerned in the conservation of our wild life, the Government passed an order in council on December 28th, 1916, creating an inter-departmental Advisory Board on Wild Life Protection. The Board is constituted of the following officials: Mr. James White, Assistant to the Chairman of the Commission of Conservation, Mr. White is Chairman of the Board; Mr. Duncan C. Scott, Deputy Superintendent General of Indian Affairs, whose concern for the welfare of the Indians and Eskimos throughout Canada brings him into close relationship with the objects of the Board; Mr. J. B. Harkin, Commissioner of Dominion Parks, Department of Interior, under whose direction the Dominion Parks, including the animal parks and the administration of the game protective legislation, as will be mentioned later, are placed; Dr. R. M. Anderson, in charge of mammals in the National Museum, whose continued studies of the wild life in the Arctic and the Northwest Territories since 1908, first, as a member of the Stefansson-Anderson Expedition of 1908-1912, and later, in charge of the Scientific party of the Canadian Arctic Expedition, 1913-16, have given him an invaluable first-hand knowledge of the mammals and birds, their habits, distribution and abundance in the north, which knowledge has already been of great value in the work of the Board; I constitute the fifth member of the Board and act as Secretary.

Eight meetings of the Board have been held during the year and numerous committee meetings of the members particularly concerned in the various matters submitted for consideration and action. Further, the Board has invited to its meetings from time to time to assist in its work other officers of the Government service, as Mr. J. M. Macoun, Chief of the Biological Division of the National Museum, Mr. P. A. Taverner, Ornithologist of the same Department, Lt.-Col. F. W. White, Controller of the Royal Northwest Mounted Police, Mr. F. H. Gisborne, Parliamentary Counsel, officers of the Hudson Bay Company, and Mr. Maxwell Graham of the Parks Branch of the Department of Interior. The following

are the chief matters that have been dealt with during the past year:

1. THE MIGRATORY BIRDS CONVENTION ACT—The conclusion of the International Convention between Great Britain and the United States for the protection of Migratory Birds in Canada and the United States, in December, 1916, necessitated the enactment of legislation to put into effect the provisions of that Convention. Accordingly, the Board was charged with the duty of drafting such legislation and the Migratory Birds Convention Bill was drafted and approved by the Government. It was introduced in Parliament by Hon. W. T. Roche, Minister of the Interior, on June 21, 1917, and, after being passed without amendment, received Royal assent and became law on August 31, 1917.\* The Regulations by which the provisions of the Act will be put into effect are now being drafted. It is satisfactory to be able to record that already the provinces of Manitoba, Saskatchewan and Alberta have, during the past year, amended their game laws to bring them into conformity with the provisions of the Convention. In addition, personal conferences have been held with the departments concerned of the Ontario and other Provincial Governments of eastern Canada on the subject and all have expressed their intention of making such amendments as may be necessary in their provincial game laws to conform with the terms of the Convention. The subject has also been taken up with the authorities in British Columbia, to the exceptional conditions of which province special consideration has been given. So far as possible, it is intended that the enforcement of the provisions of the Act shall be effected by means of the machinery already existing in the various provinces, to avoid any unnecessary duplication. It is proposed to appoint a special officer to administer the Act and regulations under the direction of the Commissioner of Dominion Parks, and the Advisory Board will supervise the general policy. An appropriation has been made by Parliament for the expenses of administration. The enactment of this measure constitutes the greatest forward step ever taken in this country in the interests of bird protection.

The United States Government submitted their necessary enabling legislation to Congress in January, 1917, but progress was affected by the entry of that country into the war. However, it is confidently expected that their enabling act will be passed before the end of the present year.

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\*The full text of this Act appears as Appendix I.

2. THE NORTHWEST GAME ACT—Following my address before this Commission in January, 1917, a resolution was passed by the Commission embodying the proposals which were then made, the chief of which were: 1. The revision of the Northwest Game Act to meet the urgent need of increased protection to the wild life in the north; and 2. The administration of such legislation by a duly authorized officer; the Commissioner of Dominion Parks was recommended as that officer already had charge of the national animal parks and reserves. It will be a matter of great satisfaction to the Commission to learn that the recommendations then made have been carried out.

Early in the present year, the Advisory Board undertook the complete revision of the Northwest Game Act which relates to the protection of the game and fur-bearing animals and birds of the Northwest Territories. The task was by no means a light one and after a large amount of work and study, a Bill was drafted and approved. This was introduced in Parliament by Hon. W. T. Roche on June 21, 1917, and after certain amendments which did not detract from the value of the measure, it became law at the close of the last session.\*

It will be observed that, in addition to providing for close seasons for game, for fur-bearing animals and for birds, an absolute close season is provided for buffalo, thus ensuring the continued protection of the herd of about six hundred buffalo which is still to be found, it is gratifying to know, in the region west and northwest of Fort Smith. The killing of musk ox and wapiti is also prohibited except in such areas as may be prescribed by order in council. It is hoped by this means to prevent the continued decrease to the point of extermination of that unique member of our northern fauna, the musk ox, which has become so seriously reduced in numbers in recent years on account of the value of its pelt and the consequent excessive hunting, particularly by the Eskimo.

One of the most important and valuable features of the new Act is the introduction of the policy of licensing all persons engaged in hunting, trapping or trading in game, including fur-bearing animals, in the Northwest Territories. This will enable the Government to control the situation and to prevent undesirable exploitation of the game and, especially, of the fur resources of the north. We hope that it will be the means of putting an end to the activities of persons whose operations are opposed to the principles of conservation and thus ensure for the legitimate traders and the inhabitants of the north a source of livelihood for all time. Provision is

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\*The full text of the Northwest Game Act appears as Appendix II.

also made for the regulation of the use of poison which, in many sections of the north, is reported to be a serious menace to the wild life.

The Commissioner of Dominion Parks has been entrusted with the administration of the Act and regulations under the supervision and with the advice of the Advisory Board; and an appropriation has been made for the purpose of administration. With adequate machinery we may now confidently look forward to maintaining a policy that will ensure the conservation of this valuable natural resource of our northern regions. It should be a source of great satisfaction to the Commission to know that its recommendations have been so fully and speedily acted upon.

3. THE BARREN GROUND CARIBOU AS A MEAT SUPPLY—In view of the serious shortage of meat supplies existing at the present time owing to the war, the Advisory Board has had under consideration for some time the possibility of utilizing the enormous meat supply which the existence of countless herds of the barren ground caribou in the northern regions of Canada affords. Travellers and others have, from time to time, called attention to the possibility of utilizing the herds of caribou as a natural source of meat. These herds have been estimated by different travellers to number from ten million to thirty million animals; but, naturally, such estimates can be little more than guess work. Nevertheless, we know that these animals may be numbered by millions, and once a year, during the winter months, they reach in their southward migration the northern limit of tree growth extending in the Northwest Territories from Churchill on Hudson bay in the east to the neighbourhood of lake Athabaska in the west. The chief difficulties with which we are faced at present are lack of labour and adequate means of transportation and storage. There are several alternative methods of reaching the herds during their winter sojourn and these, together with the difficulties I have mentioned, are now being investigated. Should any method of making use of such a natural meat supply be found feasible, it would be necessary to put it into effect under government administration, and the control which is possible to exercise under the Northwest Game Act would prevent any exploitation of this valuable natural resource by private interests.

This problem of the conservation and possible utilization of the barren ground caribou herds is one of the chief subjects to which the Board is devoting its attention, as it is a matter of immense importance to our northern territories and to the country as a whole. In my address before the Commission two years ago, the situation

was reviewed and I will therefore omit any full discussion at the present time, as the subject is dealt with at some length in the account that I am preparing of the present status and conservation of the wild life of this country.\* I would again direct your attention, however, to the fact that whereas the barren ground caribou have been seriously reduced in numbers in Alaska and practically exterminated in certain regions such as the Alaskan Arctic coast, with the result that domestic reindeer of Siberian origin are now to some extent taking their place, we have still in northern Canada immense herds of native reindeer to supply food and clothing to the native population. But if you will realize that the caribou in Canadian territory have been killed off to such an extent in the Mackenzie Delta region that the Eskimo of that region, as I am informed by Dr. Anderson, are importing skins of domestic reindeer from Alaska for clothing, you will appreciate the significance of the problem with which we are dealing.

The possibilities of the use of semi-domesticated and domesticated caribou or reindeer under adequate supervision have been strikingly demonstrated by the history of the domestic reindeer in Alaska. It would be out of place to give in a review of this nature an account of that wise policy but the following summary statement will indicate what can be accomplished. The latest report that I have received regarding the reindeer herds in Alaska is that for the fiscal year ending June 30th, 1915.† This Report gives the following account of the reindeer service:

"The reports from the reindeer stations for the fiscal year ended June 30th, 1915, show a total of 70,243 reindeer, distributed among 76 herds. Of the 70,243 reindeer, 46,683, or 66 per cent, were owned by 1,140 natives; 3,408, or 5 per cent, were owned by the United States; 8,890, or 10 per cent, were owned by missions; and 13,262, or 19 per cent, were owned by Lapps and others. The total income of the natives from the reindeer industry during the fiscal year, exclusive of the meat and hides used by the natives themselves, was \$81,997. The total, 70,243, is a net increase of 21 per cent during the fiscal year, notwithstanding the fact that nearly 9,000 reindeer were killed for meat and skins during the year.

"The reindeer enterprise in Alaska has successfully passed through two stages—the introduction of the reindeer to a new country and people, and the development of an administration which has established the industry in the coastal region from Point

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\* This report, intituled *The Wild Life of Canada and its Conservation*, will be published in the near future by the Commission of Conservation.

† *Report on the Work of the Bureau of Education for the Natives of Alaska 1914-15*. Bulletin, 1916, No. 47. Bureau of Education, U.S. Department of Interior, Washington, D.C., 1917.

Barrow to the Aleutian peninsula. There remains the successful commercializing of the industry, the advancement of the enterprise from a branch of industrial education to one of the industries of the country.

"Realizing that the establishment of an export trade in reindeer products is essential to the success of the enterprise, the bureau is encouraging the shipment of reindeer meat and hides from Alaska to the States. The last steamer brought to Seattle in October, 1914, 25 carcasses of reindeer which were placed on sale in Seattle, retailing at from 20 to 35 cents per pound. The chief of the Alaska division also brought from Nome 3 carcasses to be distributed among the five continental railway lines running out of Seattle, in order that reindeer meat might be given a trial on dining cars, with a view to securing for the natives contracts for the delivery of reindeer meat each season.

"During the winter of 1914-15 the Bureau's superintendent, who is situated at Nome, with the approval of the Commissioner of Education, distributed among the Eskimo herders in northwestern Alaska a proposal from a cold-storage company operating between Seattle and Nome to market in Seattle for the Eskimos on a commission basis, the reindeer meat consigned to said company. This action will probably result in the shipment of a considerable quantity of reindeer meat from Nome during the summer. The responsibility of accepting or rejecting the proposal of the cold-storage company will rest with the native owners of reindeer, the superintendents acting in an advisory capacity and assisting in making the necessary arrangements.

"Soon after the inception of the reindeer enterprise certain Lapps were brought from Lapland to Alaska and employed by the Bureau as instructors of the Eskimos in the care and management of the reindeer, each Lapp receiving a certain number of reindeer in payment for his services. During the summer of 1914, a company, organized at Nome, purchased about 1,200 reindeer from one of these Lapps. This company intends to purchase other herds now owned by Lapps, and to engage in the exportation of reindeer meat and hides.

"Under the supervision of the superintendent of the Northwestern district a very successful convention, attended by about 200 of the Eskimos engaged in the reindeer industry on the Seward peninsula, was held at Igloo from January 11th to 17th. The main object of the convention was the exchange of experiences and opinions on matters connected with the raising and the utilizing of reindeer. The discussions included such subjects as the best way to slaughter a reindeer and prepare it for market, the most satisfactory forms of sleds and harness, and the best methods of driving reindeer. There were also shooting matches, rope-throwing contests, wrestling bouts, and many kinds of races with reindeer. The exhibits included sets of harness, sleds, halters, and clothing made of reindeer skin, for which prizes were awarded. The success of this convention will probably result in the holding of similar conventions annually in various centres of the reindeer industry.





#### THE WAPITI OR AMERICAN ELK

This magnificent animal, the finest member of the deer tribe in North America, is now permanently protected throughout its range in Canada, except in Saskatchewan, where permanent protection has been urged. Thousands of these animals have been ruthlessly slaughtered in the past merely for the sake of their teeth.

(The above illustration is copyright, and is from a painting by Mr. Carl Rungius, whose courtesy is hereby acknowledged).

"The reindeer industry is now extending from the mainland to the outlying islands. During August, 1914, upon the request of the Department of the Interior the revenue cutter *Manning* conveyed a herd of 40 reindeer from Ugashik, on the Alaska peninsula, to Atka, a remote island in the Aleutian chain, where it will be a valuable factor in alleviating the deplorable conditions which have hitherto prevailed upon that desolate island. The extension of the reindeer industry in southeast Alaska was begun during October by the shipment of Metlakatla, on Annette island, of eight reindeer from the herd in the vicinity of Nome."

4. ANTELOPE OR PRONGHORN—The few remaining small herds of this singularly interesting and beautiful member of our former plain dwellers are to be found in Saskatchewan and Alberta. Every effort is now being made by the different authorities concerned to prevent this species from vanishing completely from our fauna. Such a fate, from a scientific point alone, would be a loss of first magnitude. The close season for antelope in Alberta expired during the year and we are pleased to record the wise action of the Alberta Government in extending the close season for a further period of years, namely until 1925. The Board memorialized the government on the importance of such a step. As a permanent close season on antelope is in force in Saskatchewan, the animal is absolutely protected by law throughout its present range and we earnestly hope that the governments concerned will make special efforts to ensure strict observance of the law.

5. WAPITI OR ELK—This, our finest member of the deer tribe, which formerly existed in abundance from Quebec to British Columbia, has suffered the fate of its congeners. Every effort, however, is being made to encourage the increase of the small number that still remain. In British Columbia, a wise policy of absolute protection is resulting in an increase in numbers and an extension of range. Absolute protection is given to such wapiti as remain in Alberta. The new Northwest Game Act establishes an absolute close season in the Northwest Territories. In Saskatchewan, where a few hundred wapiti are still to be found in the northern part of the province, the bag limit has been reduced to one male. During the year the Board addressed a strong recommendation to the Government of Saskatchewan that an absolute close season be declared, as the concensus of opinion of sportsmen and others in the province is against further killing of this animal, which is rapidly decreasing in numbers for lack of such protection. In Manitoba, the number of wapiti is estimated to be from 600 to 700 animals. They are chiefly to be found in the Riding Mountains Forest Reserve, a portion of which is a provincial game reserve. Others occur in the

neighbourhood of lake Winnipeg. As steps were being taken to amend the provincial game law of Manitoba to provide, among other useful steps, an absolute close season on wapiti, the Board strongly supported this proposal and urged that such action be taken. We are pleased to record that the law was so amended as to provide for such absolute protection. As the matter now stands the wapiti enjoys absolute protection throughout its range in Canada with the exception of Saskatchewan, and we sincerely hope and have reason to believe that a permanent close season in that province will be declared at the next session of the provincial legislature.

During the past year the Dominion Parks Branch of the Department of the Interior imported over fifty wapiti from the large herd at Jackson Hole, Wyoming, into the Rocky Mountains park, and it is proposed to use these as a nucleus to repopulate that section of the Rocky Mountain region with this animal.

6. WOLVES.—Throughout Canada, wolves are proving to be an increasing menace to a number of our game animals such as deer and mountain sheep. In Ontario, reports of their destructive activities are increasing and stronger efforts to secure a much needed reduction in their numbers are urgently necessary. From Yukon territory, an appeal was addressed to the Government that steps should be taken to reduce the wolves which are making determined inroads on the mountain sheep. As any action taken in that region would require co-operative effort on the part of the United States Government in Alaska, the Board took up the matter with the United States authorities in Washington, but owing to the difficulties of obtaining the necessary men required for any effective steps, no arrangements could be made at the present time. While increased bounties would greatly assist in securing a reduction in the number of wolves, the Board is strongly of the opinion that the only satisfactory method of dealing with the wolf problem is by organized hunting under Government direction. The wisdom and value of the latter scheme has been conclusively shown by the work of the Biological Survey of the United States Department of Agriculture in the western states, where wolves have proved a menace to the live stock interests. It is hoped that after the war, definite action along somewhat similar lines may be taken in Canada.

7. PROPOSED GAME SANCTUARY AT POINT PELEE, ONT.—During the year, the Board has taken active steps with a view to the establishment of a game sanctuary at Point Pelee in Ontario. From time to time, efforts have been made to secure the permanent



POINT PELEE, ONT.

A corner of one of the many open ponds in the marsh; the camera faced the west and in the background may be seen the trees on the strip of upland which runs down the west side of the marsh to the end of the point.



Photos by Dr. C. Gordon Hewitt.

CANADA GEESE AND WOOD DUCK

A photograph taken on the farm of Jack Miner, Kingsville, Ont., which has now been declared, together with the farms immediately adjoining it, to be a Provincial Game Reserve.



reservation of this unique portion of Canadian territory which is the property of the Dominion Government, being an old naval reserve. It is a triangular point of land in Essex county, extending for about nine miles into lake Erie and measuring about six miles across the base of the point. The peculiarities of the flora and fauna and the desirability of such a reservation are fully discussed in a memorandum submitted to the Commission by Mr. P. A. Taverner, Ornithologist of the Geological Survey, in 1915, and published in the *Sixth Annual Report* of the Commission, pp. 304-307. Not only is it the most southerly point of Canada, geographically, and in the character of its birds, trees and plants, but it constitutes one of the concentration points in the northern and southern journey of our migratory birds. In the spring and in the autumn, enormous numbers of birds of all species in their migratory journeys to and from Canadian territory concentrate at this point and its reservation, therefore, would be an important factor in ensuring the protection of our migratory birds. The area includes a marsh several square miles in extent which forms a favourite resort and breeding place for wild fowl, but excessive shooting has reduced its value as a breeding place. Pine, oaks, red cedar, black walnut, and hackberry grow in profusion on the narrow strip of land running down the west side of the point and make it a tract of singular beauty to the lover of trees and shady groves. Its scenic value, the southern nature of its birds and plant life, its importance as a main route for migratory birds and the exceptional opportunities it affords for the protection and encouragement of wild fowl, insectivorous and other birds, all combine to make it an ideal area for a national reservation. I was particularly impressed with these facts when I visited the Point in April and September.

We have every reason to believe that within a short time our efforts will be successful and that Point Pelee will be added to the number of wild life reserves now administrated by the Parks Branch of the Department of Interior.

8. BONAVENTURE ISLAND BIRD CLIFFS—The Board has continued the efforts previously made by the Commission to secure as a bird sanctuary the cliffs on Bonaventure island off the coast of Gaspé in the gulf of St. Lawrence. This proposal has been most sympathetically endorsed by the Hon. Honoré Mercier, Minister of Colonization, Mines and Fisheries of Quebec. Mr. James White and I have visited Quebec twice during the autumn for the purpose of securing the reservation of these cliffs, which rise to a height of about 300 feet from the sea and furnish ledges

on which thousands of sea birds such as gannets, murres, razorbilled auks and puffins breed, and we hope that in the near future the necessary arrangements may be made. In 1914, Mr. Taverner estimated that there were about 7,500 birds nesting on these cliffs. Their importance, therefore, in the protection of these birds is obvious. At the present time, deplorable slaughter of the birds takes place and their dead bodies are cast up on the shores of the neighbouring mainland to rot. The need of such a protective measure as this proposal involves is very urgent.

9. BIRD RESERVATIONS IN WESTERN CANADA—In the provinces of Alberta and Saskatchewan, the Department of the Interior has withheld from settlement, 28 areas, chiefly in the neighbourhood of lakes, that were not considered to be of agricultural value but, on the other hand, formed suitable places for the breeding of numerous species of wild fowl. With the opening up of these regions for agricultural settlement and the draining of the existing bodies of water, the breeding places of ducks and other wild fowl in the west have been greatly reduced with the consequent reduction of the numbers of wild fowl breeding locally. The Board was requested to advise on the desirability of the permanent reservation of those areas most suitable for bird reservations, and Dr. R. M. Anderson, one of our members, was accordingly requested to make a personal examination of the areas provisionally withheld from settlement. In September and October, Dr. Anderson visited twelve of the areas in Saskatchewan and six in Alberta, and although the Board has not had an opportunity as yet of considering his report, he has informed me that he found that all but three or four of the areas examined constituted desirable bird reservations. It is anticipated that the areas that were found suitable will be permanently reserved bird sanctuaries under the provisions of the Migratory Birds' Convention Act.

The foregoing brief recital of the more important subjects to which the Advisory Board on Wild Life Protection has given its attention during the first year of its existence not only demonstrates very clearly the value of such a body but also the advantage of co-ordinated effort in the government service. The usefulness of the work of the Board will undoubtedly continue as time goes on. It will ensure the carrying out of well-considered policies in respect to all matters affecting the conservation of wild life, and we hope that it will also be the means of assisting the various provinces in the efforts to conserve the wild life in the territories under their respective jurisdictions. These problems are national in character and there cannot be too great a spirit of co-operation with a view to securing



POINT PELEE, ONT.

The end to the point. This is the most southerly point in Canada. This point is gradually being washed away owing to the removal of the sand by "sandsuckers" operating near the shore; on the right may be seen uprooted trees and the three men in the foreground are standing at the foot of the face of the retreating point. The privilege of removing sand near the shore must be discontinued to prevent further rapid erosion of the point.



Photos by Dr. C. Gordon Hewitt.

POINT PELEE, ONT.

Looking south-eastward across the marsh which affords excellent breeding and feeding facilities for ducks, rails, bittern and other birds; this marsh would be included in the proposed wild life reserve.



the necessary protection that the continued welfare of our wild life requires.

#### PROGRESS IN BIRD PROTECTION

Reference has already been made in the foregoing report of the work of the Advisory Board in regard to the Migratory Birds' Convention Act. The enactment of this measure has been welcomed on all sides as a guarantee of the Government's intention to undertake such steps as are possible to protect our insectivorous birds and wild fowl.

**Educational Work** Throughout the country there has been a very marked awakening of public interest in the protection of our native birds and the progress of the movement has been very encouraging. Educational work in the schools through which we must aim to mould the public opinion of the future has been extended. The subject naturally appeals to the youthful mind when presented in the proper manner. Among the educational agencies in this country, the Canadian Society for the Protection of Birds, with headquarters at Toronto, has done great service. The recent formation of the Province of Quebec Society for the Protection of Birds with headquarters at Montreal will materially help in the educational work in that city and the province as a whole. In St. John, N.B., the junior Branch of the Natural History Society of New Brunswick is carrying on an active campaign among the children; and throughout the country similar organizations are undertaking educational work along these lines. The value of such organizations as means of creating an active interest in the protection of birds cannot be too strongly emphasized. There has been a continued increase in the practice of holding bird-house competitions in the cities and towns during the year. In many cases, splendid results were obtained. In Ottawa, for example, we arranged through the Ottawa Humane Society to hold such a competition among the boys of the public schools. The Public School Board and teachers heartily co-operated and bird houses were made as part of the work in the manual training classes, with the result that, last spring, an exhibition of over 1,000 bird houses was held. The important feature of this work was that, while many of the nesting boxes were sold to the public on behalf of the Red Cross, the majority were used by the boys around their homes.

**Urban Bird Sanctuaries** For some time, I have been urging the establishment of bird sanctuaries in and around our cities and towns, and encouraging progress has been made in this direction. Several years ago bird sanctuaries were established in the neighbourhood of Ottawa, of which an account has already

been published in the Ottawa Naturalist, March, 1914. On my recommendation the Board of Park Commissioners of Vancouver, B.C., has established, during the past year, a bird sanctuary in Stanley park, and the Quebec Society for the Protection of Birds is arranging to establish bird sanctuaries on Mount Royal, Westmount, and in the public parks and cemeteries in and around the city of Montreal.

**Community Bird Sanctuaries** I would strongly recommend local organizations and public bodies to adopt and carry out the following scheme as a first step. The absolute protection of birds in public parks and cemeteries in cities, towns and villages should be secured by the co-operation of the local civic authorities and such areas should be publicly declared to be bird sanctuaries. At the same time, bird-house competitions should be organized and a proportion of the bird houses so made by the school children should be distributed in the civic bird sanctuaries, and thus the children would have that personal interest in the work which tends to secure success. Further, the assistance of the local horticultural societies should be enlisted and they should be asked to help the civic or other authorities in the work of planting suitable fruit-bearing and other shrubs and trees attractive to birds in the local sanctuaries; or these associations could make themselves entirely responsible for such work. Prominent citizens should then be encouraged to present bird fountains and baths to be placed in the bird sanctuaries. Each year, preferably in the spring, a local 'Bird Day' might be instituted. On that day, the schools would devote special attention to the subject of birds and bird protection and means could be taken to enlist the interest of the general public. By these and other means that might be devised, every section of the community could be called upon to take a personal interest in the protection and encouragement of the birds in their district and the work would express the community spirit. I cannot conceive of any practical measure that would have a greater effect in stimulating public interest in this subject, and the value of such work throughout Canada as a whole would be inestimable. Where interest is kindled in the minds of young and old on the subject of birds, it increases with time and few subjects have a wider appeal or elicit to a greater extent that sympathy with and admiration for our wild life.

**Prairie Chicken**

The extraordinary scarcity of the prairie chicken, which popular name in western Canada includes both the pinnated grouse (*Tympanuchus americanus*) and the prairie sharp-tailed grouse (*Pediocetes phasianellus*), has created a feeling of considerable uneasiness in the Prairie provinces.

A few years ago, they were fairly abundant in the farming sections of the prairies, but, during the last two years, they have disappeared almost completely in some sections and, generally, are extremely scarce. In view of these facts, the provincial governments of Manitoba, Saskatchewan and Alberta have established an absolute close season on prairie chickens in the hope that such timely action will result in securing an increase in the numbers of birds from the remaining flocks. We should profit by the unfortunate history of this bird in the western states where the prairies in the states of Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, and Nebraska were well stocked with prairie chickens (*T. americanus*), but the market hunters soon commenced operations with the inevitable result of almost complete extermination. While over-shooting, which has been largely brought about by the increasing use of the automobile, has undoubtedly caused the disappearance of the prairie chicken in many districts, natural causes have also exerted a pronounced influence. Cold wet springs have killed off the young birds; and the greater abundance of goshawks, probably due to the scarcity of rabbits throughout the north, has also seriously reduced the numbers. While the indiscriminate killing of hawks is to be most strongly deprecated, it is very desirable that steps should be taken to reduce the numbers of this most destructive species of hawk, which is one of the greatest enemies of our game birds and, by its inroads on the poultry yard, is responsible for the bad reputation which is unfortunately given to all hawks, many species of which, such as the red-tailed hawk and sparrow hawk, are of great economic value as destroyers of such pests as gophers, mice and grasshoppers.

#### WILD LIFE CONSERVATION AND FOOD PRODUCTION

It is very desirable that, at the present critical period in the history of the country and the world generally, we should consider what relation our wild life bears to the chief problems with which we are faced, namely, the production and conservation of food supplies. In their relation to this problem, the native mammals and birds may be divided into three classes: (1) Sources of food; (2) Protectors of food; and (3) Destroyers of food.

##### Sources of Food

From the time when the early settler depended almost entirely upon the wild life as a source of meat up to the present time when the population has increased to so great an extent that, to prevent extermination, it is inadvisable to provide more than short open seasons, our wild life

has furnished meat. It is this fact that has led to their destruction. Wapiti, moose, caribou and deer all furnish meat of most excellent quality. To these, are added the native game birds: wild turkey, (now extinct in the wild state in Canada) geese, ducks, grouse of several species, quail and shore birds, all excellent food and all diligently sought after. The smaller mammals, such as hares and rabbits, have also a place in the bill of fare.

During the open seasons many people will take advantage of the opportunity to add to the domestic meat supply by obtaining one or more deer or moose, in accordance with bag limits imposed by the provincial game laws. The possibility of utilizing cold storage will help to solve the problem of making the best use of game killed during the open seasons. From all reports that I have received, it would appear that a greater number of persons have availed themselves this year of the presence of a native meat supply in the different provinces. In many cases, it was not in the interests of sport that they ranged the woods, but as a result of the most primitive and impelling motive—to secure food. There is little doubt in my mind that throughout the country full advantage has been taken of the opportunity to secure wild meat.

**Relaxation of  
Laws Serious**

It has been suggested that the game laws of the various provinces might be relaxed to permit a greater use of our wild life as a source of food.

While this suggestion is undoubtedly made with the best of intentions, if put into practice it would undoubtedly result in consequences of a most serious nature which are not realized by those unacquainted with the present status of our wild life and with the progress of game legislation and its enforcement. The relaxation of our game laws would be wholly inimical to the welfare of our game mammals and birds and completely opposed to the strenuous efforts that are now being made by the Dominion and Provincial Governments to secure better protection for game of all kinds. The chief cause of the depletion of our game resources has been either the absence of game laws or laxity in their enforcement. Violations are still all too common and not infrequently, for reasons which need not be discussed here, they are winked at by the authorities. For a number of years, those who realized what would be the outcome of continued excessive destruction in this country, which is the last stronghold of the chief game animals and birds of North America, have been striving hard to secure the greater protection that was needed to prevent reduction to the point of extermination. The struggle has been very uphill work, but owing to the attitude of the real sportsmen, as opposed to the market hunters and 'game hogs,' and of the public

generally, steady progress has been made and the provincial authorities are seriously endeavouring, not only to prevent further reduction in the number of certain game animals, but to secure some increase by the better enforcement of their laws and more appropriate close seasons.

Therefore, to relax these efforts at the present time would more than undo the results of the hard work and effort of years and would be catering to those individuals who have been the greatest enemies to game conservation, men who are entirely selfish in their point of view and who have very little interest in the welfare of the country as a whole. In the West, this class is largely made up of foreigners. To all these persons who violate the game laws on all occasions, food conservation has no meaning, and any relaxation of the game laws would simply legalize their destructive tendencies to the detriment of the rights of game and the rights of those who are accustomed to observe the law.

The amount of wild meat that would be obtained would be comparatively small, but the destruction involved in obtaining it would affect in the most serious manner possible the future of our game animals. We hope that the continued progress that is being made in game conservation may ultimately mean that we can utilize our wild meat supply, that the numbers of deer, for example, will so increase in non-agricultural areas as to make such areas productive. But this will only come about provided the strict enforcement of the game laws is continued and our hopes will be frustrated by the results of any relaxation.

In cases of absolute want or necessity, it is always possible for the provincial game officers to make special arrangements under permit. In British Columbia, the provincial game warden during the past two years has repeatedly authorized his wardens to kill deer out of season in order to supply meat to families in need. In this way, the door is not thrown open to those who normally take every advantage of killing all they can, regardless of the consequences to the future of the animals involved.

Protectors  
of Food

The greatest enemies to our food crops are insect pests, which attack the plants both below and above ground. Of all natural agencies tending to keep in check such pests and to suppress outbreaks, the many species of insectivorous birds play a very important rôle. Without the aid of these most valuable allies in destroying the enemies of our crops, our food production would be most seriously affected by the unrestrained ravages of the ever-increasing number of pests to which crops of all kinds are subject. The protection of insectivorous birds

is at all times a necessary measure in crop production. At the present time, when the production of food crops is not only a national but a world necessity, the protection of such birds should be regarded as a measure of national defence.

In addition to the assistance rendered by insectivorous birds, other members of our wild life render valuable help in the protection of our food crops by destroying insect pests and such other enemies of crops as field mice and gophers. Skunks destroy large numbers of insects; moles and shrews perform a similar service. Hawks and owls kill countless numbers of gophers and mice. The value of the lower forms of animal life such as snakes, frogs, and toads in destroying crop pests is not generally realized, but, at the present time, it is very desirable that their usefulness in this direction should not be overlooked.

**Destroyers of Food**      The immense destruction to growing grain and other food supplies by gophers, rats and mice is not sufficiently appreciated by the general public. It is of the utmost importance that the destructive powers of these members of our wild life should be brought home to every one at a time when the conservation of food is the most vital necessity.

**Gophers**      Throughout western Canada, no farm pest is more widely disliked than the pocket gophers (*Thomomys talpoides* Rich.) whose destruction to growing grain is immense. On this account the farmers are compelled to follow a vigorous policy of destruction as a matter of self-defence. The following records obtained by the Dominion Experimental Station at Scott, Sask., in 1915, will serve to illustrate the extent of the damage due to gophers, especially where grain is grown adjacent to open uncultivated prairie. Comparisons were made of the yield per acre on portions of fields attacked and portions unattacked and it was found that the loss per acre caused by gophers was 11 bushels, 5 pounds of oats and 18 bushels, 26 pounds of barley.\* During 1917, the Provincial Governments of Manitoba and Saskatchewan adopted the wise policy of enlisting the help of the boys and girls in the country schools in the destruction of gophers. The gopher usually has two broods during the season and the object of the campaigns was to secure the destruction of as large a number of the animals as possible at the beginning of May before breeding commenced.

In Manitoba, the campaign was organized by Professor V. W. Jackson of the Manitoba Agricultural College. The first five days

\**Experimental Farms Bulletin*, No. 31, Second Series, Dept. of Agriculture, Ottawa, 1916.

in May were selected for the gopher-killing contests. Essays on gophers were written in the country schools and many of the manufacturers of gopher poisons offered prizes for the best essays and for the greatest numbers of gophers killed. One boy claimed to have killed 1,082 gophers with one packet of poison. The chief methods of destruction adopted were drowning and trapping, but shooting was widely practised. The best record of the province was obtained by Alex. Henry of Rapid City, Man.; although only fourteen years of age he shot 386 gophers in one day. Two Glenboro school girls shot 141 and 132 gophers, respectively, on May 5. Altogether in this campaign, about 100,000 gophers were killed in the province; this number was considered to represent about one-tenth of the total.

In Saskatchewan, the Provincial Department of Agriculture organized the gopher-killing campaign among the school children. May 1st was set aside as 'gopher day.' Thirty-six bronze shields were offered to the school districts for the schools gaining the highest number of points. The highest record was obtained by Gutenberg school which collected 7,682 tails. Christian Reiter of this school won the first prize with 2,092 gophers to his credit. As a result of this competition, 514,140 gophers were killed in the province; this number represented 524 gophers for each school. Half a million gophers killed in the spring would represent about two and one quarter million gophers in July and August when the crop destruction is effected. Assuming that each gopher eats ten cents worth of grain the boys and girls who participated in the contest saved the country about \$200,000 worth of grain, which was a notable contribution to the cause of food conservation. As a result of this success of the campaign, a Junior Agricultural Service League has been formed in Saskatchewan. To qualify for admission, it is necessary to kill 50 gophers; a bag of 200 qualifies for third rank, 500 for second rank and to secure promotion to the first rank 1,000 gophers must be killed. Silver and bronze medals will be given in competition. As a means of dealing with this serious problem in the West, the enlisting of the help of the boys and girls on the farms will undoubtedly yield valuable results.

#### Rats and Mice

The destructive powers of rats and mice are well known but the manner in which their presence is tolerated in city and country would indicate that the immense losses they cause are not fully appreciated. Of all animals, the rat is the worst pest. As a carrier of bubonic plague, it is a serious menace to public health; as a destroyer of grain, stored foods of all kinds, eggs, chickens, and other food products, it is

unequalled. And yet no serious efforts are made to cope with this powerful enemy in our midst.

Bubonic plague is transmitted from rats to human beings by fleas. The destruction of rats is an essential step in the protection of communities from this disease. In the fourteenth century, it is estimated that about 25,000,000 people died in Europe from the 'black death,' as this disease was called, and 2,000,000 deaths are stated to have occurred during the epidemic of plague in India in 1907. Modern methods of preventing the spread of plague involve the most vigorous eradication of rats.

But we are concerned now with the destruction of food by rats, which, as I have stated, is not sufficiently appreciated. In Europe, it was estimated in 1907, after a full inquiry, that the average annual loss caused by each rat in Great Britain equalled \$1.80, in France \$1.00 and in Denmark \$1.20. The losses in the rural districts in Great Britain and Ireland due to rats in the same year were computed at \$73,000,000; and a capital of about \$10,000,000 was employed in the industry supplying means to destroy rats. At the present time, the English Board of Agriculture is making special efforts to combat the rat pest in England. Mr. E. W. Nelson, Chief of the Biological Survey of the United States Department of Agriculture, in a recent valuable article\* on the rat pest, estimates the annual losses in the United States due to rats to equal at least \$200,000,000. He further makes the interesting statement that in order to feed and otherwise provide for this enormous destructive army of rats the labour of 200,000 men is required.

Mice co-operate with their larger cousins in waging this widespread campaign of food destruction. On no occasion have the destructive powers of mice been more strikingly demonstrated than during 1917 in Australia. Owing to the lack of ocean transportation, vast quantities of grain destined for export have accumulated in New South Wales and Victoria. A plague of mice developed and the destruction to the stored grain has been enormous. We are informed that, in some places, the ravages of the mice were so great that, in a few months, huge stacks of grain were reduced to what resembled heaps of debris.

The Wheat Board in New South Wales organized a campaign of destruction. In one place, the catch for two nights totalled seven tons of mice. In another place, 56,000 mice were caught in four nights. This was an exceptional outbreak but it serves to show the destructive power of these small creatures in the mass. Everywhere destruction is proceeding and everywhere there is

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\**National Geographic Magazine*, July, 1917.

greater need than ever for the conservation of every bushel of grain and every pound of food.

When the prolific habits of rats are taken into account the extent of the menace they constitute will be made still clearer. The brown rat begins to breed when about three or four months old; they breed from six to ten times a year and produce, on the average, ten young in a litter. If we imagine a pair of rats breeding at this rate for three years without any deaths among their progeny, at the end of that short period the number would be increased to over 350,000,000 rats.

The main reasons for the abundance and destructiveness of rats and mice is that we provide food and shelter for them. To combat them successfully, we must refuse them both these vital essentials. Shelter should be denied by making buildings and other haunts rat-and mice-proof by various constructional methods. Seed grain, provisions, etc., should be stored in rat-proof containers. The adoption of sanitary conditions in towns and cities, cleanliness, about stores, warehouses and other buildings will help to eradicate them. The maintenance of garbage dumps is one of the greatest causes of rat abundance; incineration is the only sanitary method of treating garbage. Systematic campaigns should be organized and such methods of destruction as trapping, poisoning, and hunting with ferrets and dogs should be adopted wherever rats occur.

Rats are destroying millions of dollars worth of food in Canada at the present time when the conservation of food is a duty that devolves upon everyone. The more food we permit the rats to destroy the less there is for us and our kinsfolk across the seas to eat. Never was the need of saving our food supplies greater; never was the need of the most relentless campaign against these food destroyers more urgent. Eradicate measures should be prosecuted with the greatest vigour wherever these pests occur, whether on the farm or in the city.

**SIR CLIFFORD SIFTON:** I am sure we are all interested in Dr. Hewitt's paper, and in thanking him for his address, I wish, on behalf of the Commission, to extend to him our thanks for the assistance he has given us in our work on several occasions. His scientific knowledge has been of great value, and, in fact, has enabled the Commission to deal with matters which it could not have dealt with if it had not had the benefit of his advice.

# Salmon Fishery of the Fraser River District

BY

JOHN PEASE BABCOCK

*Assistant Commissioner of Fisheries, British Columbia*

THE sockeye salmon which frequent the Fraser river in British Columbia are natives of that stream. All of them are hatched in its watershed and, with few exceptions, spend the first year of their life in the fresh waters of some one of its many large lakes. They then migrate to the sea, where they remain until the summer of the year they are four years old, when they again seek the waters of the Fraser to spawn, and, after spawning, die.

In returning from the sea to the Fraser, the salmon pass through many miles of American waters in the state of Washington, and there the greater proportion of the run is caught by American fishermen. It is this feature of the fishery that makes it an international one. In dealing with the salmon fisheries of the Fraser, it is necessary to deal also with the fishing operations carried on in American waters through which they pass, since it has been demonstrated that all the sockeye salmon which are taken in Puget sound, in the state of Washington, are Fraser River bred fish. The term 'Fraser River district' is here used to include all the American and Canadian waters in which the Fraser River fish are caught. In order to show an increase or decrease in the run of sockeye to the Fraser for a given year, it is necessary to compare the catch of that year with the catch in the fourth preceding year, since, as already set forth, the sockeye that run to that river predominately mature in four years, and since the sockeye seeking the Fraser are caught in both Canadian and American waters, it is necessary to take the combined catch in those waters in order to ascertain the total for any year.

Up to the present year (1917) the run of sockeye salmon to the Fraser River district made it the most valuable and, at the same time, the most remarkable salmon fishery known. Every fourth year, up to 1917, the run of sockeye salmon in that district has greatly exceeded the run to any other river, and has so greatly exceeded the run to the Fraser in the three following years that it is termed 'the run of the big year.' The run to the Fraser in

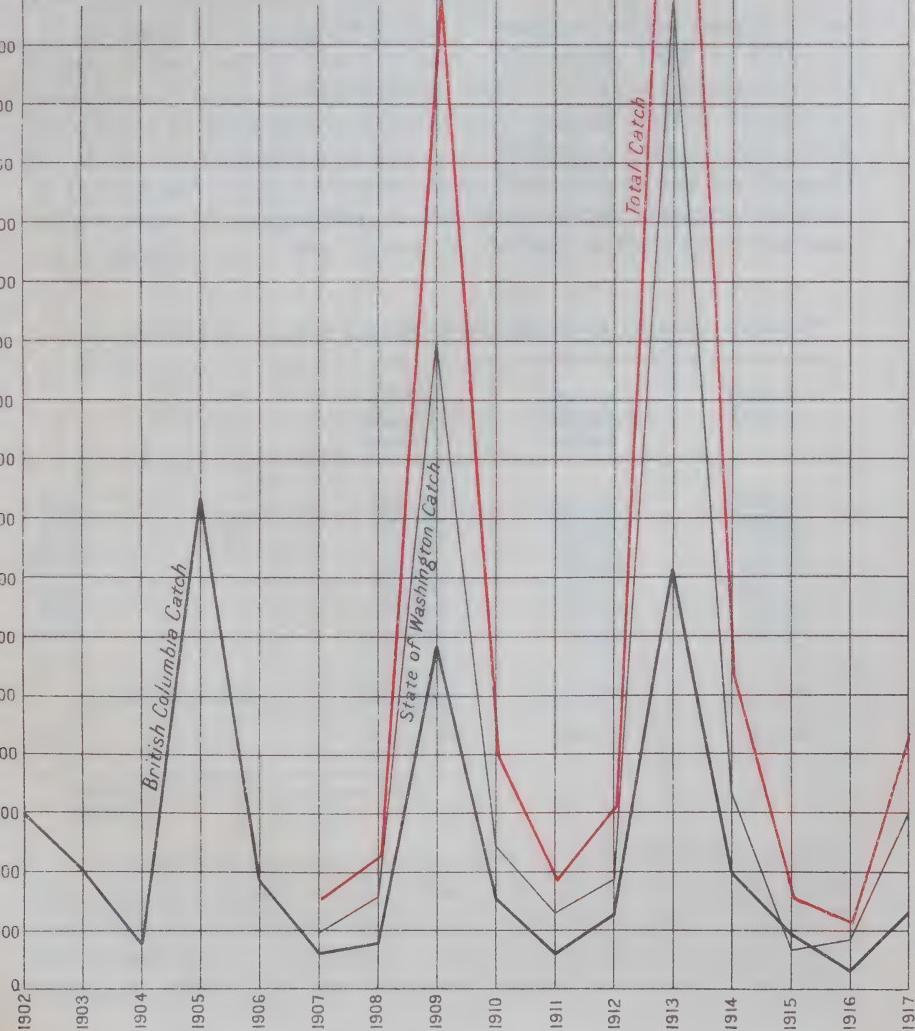
## COMMISSION OF CONSERVATION

|      | B. C.   | U. S.     | TOTAL     |
|------|---------|-----------|-----------|
| 1902 | 293,477 | *         |           |
| 1903 | 204,809 | *         |           |
| 1904 | 72,688  | *         |           |
| 1905 | 837,488 | *         |           |
| 1906 | 183,007 | *         |           |
| 1907 | 58,815  | 90,631    | 150,446   |
| 1908 | 74,574  | 155,218   | 229,792   |
| 1909 | 585,435 | 1,097,904 | 1,683,339 |
| 1910 | 150,432 | 248,014   | 398,446   |
| 1911 | 58,487  | 127,761   | 186,248   |
| 1912 | 123,879 | 184,680   | 308,559   |
| 1913 | 719,796 | 1,673,099 | 2,392,895 |
| 1914 | 198,183 | 335,230   | 533,413   |
| 1915 | 91,130  | 64,584    | 155,714   |
| 1916 | 32,446  | 84,637    | 116,783   |
| 1917 | 148,164 | 300,000†* | 448,164   |

\*Statistics for United States (State of Washington) catch of sockeye are not available prior to 1907

†Fraser River only

\*\*Estimated



CATCH OF SOCKEYE SALMON  
FRASER RIVER AND PUGET SOUND, 1902-17



each of the three years succeeding the big year is so much smaller that those years are termed 'the lean years.'

**Analysis of Pack** Nineteen hundred and nine was a year of a 'big run.' The pack in the district that year totalled 1,683,339 cases, each case containing 48 one-pound cans or their equivalent. The *combined* pack of the three following lean years totalled but 893,253 cases, or 53 per cent of that of 1909.

The pack in 1913, the next big year (and, as will later be shown to have been the *last* big year) totalled 2,392,895 cases, while the *combined* pack in the three following lean years totalled but 805,910 cases, or 35 per cent of that of 1913.

A study of the recorded pack of sockeye salmon caught in the Fraser River district, for the past eight years, 1909 to 1916, inclusive, affords a comprehensive basis for an understanding of conditions in both provincial and state waters of that district up to 1917. It demonstrates the vast difference between the catch in the big and in the lean years up to that year, as well as the great difference in the proportion of the catch in the provincial and the state waters, and it also shows the decline in the run in the lean years.

#### PACK OF SOCKEYE SALMON CAUGHT IN FRASER RIVER DISTRICT, 1909-1917

| Year                   | British Columbia waters | State of Washington waters * | Total for District |
|------------------------|-------------------------|------------------------------|--------------------|
| 1909.....              | 585,435                 | 1,097,904                    | 1,683,339          |
| 1910.....              | 150,432                 | 248,014                      | 398,446            |
| 1911.....              | 58,487                  | 127,761                      | 186,248            |
| 1912.....              | 123,879                 | 184,680                      | 308,559            |
| 1913.....              | 719,796                 | 1,673,099                    | 2,392,895          |
| 1914.....              | 198,183                 | 335,230                      | 533,413            |
| 1915.....              | 91,130                  | 64,584                       | 155,714            |
| 1916.....              | 32,146                  | 84,637                       | 116,783            |
| Totals, 1909-1916..... | 1,959,488               | 3,815,909                    | 5,775,397          |
| 1917.....              | 148,164                 | 300,000 †                    | 448,164            |

\*Data from *Pacific Fisherman*, Seattle, Wash.

†Estimate.

The pack for the eight years, 1909 to 1916, inclusive, includes the catch of the last two big years and the last six lean years. Together, they constitute the last two four-year cycles of the run to the Fraser river. The grand total for the eight years is 5,775,397 cases, of which 33.9 per cent was packed in British Columbia,

and 66.1 per cent, in the state of Washington. In every recent year, except 1915, the catch in the state of Washington waters of the district has exceeded the catch in British Columbia waters. In the two big years the pack from Washington waters exceeded the pack from British Columbia waters by more than 100 per cent, and, in 1913, it exceeded the combined pack in the British Columbia waters of the last two big years, 1909 and 1913. The pack in Washington in the six lean years exceeded the pack in British Columbia waters in the same years by 157 per cent. The decline in the catch in the lean years is pronounced. The catch in provincial waters in 1916 was only 26 per cent of that of the previous fourth year, and was 91,733 cases less than in 1912. In 1916, the pack in Washington was 100,043 cases less, or 45.8 per cent, than in 1912, four years previous.

The final figures for the pack of sockeye in the Fraser River district for 1917 are not yet available. The pack in British Columbia waters was 148,166 cases, and the pack in the state of Washington is estimated at 300,000 cases, a total for the district of 448,164 cases. This is only one-sixth of the pack of the previous big year, 1913, and shows a decrease of 1,944,731 cases, or more than 81 per cent.

**Depletion of  
Run**

It has been demonstrated in the reports of the British Columbia Fisheries Department, and by the findings of two international commissions, that the sockeye caught in the Fraser River district are predominantly four-year-olds, are all hatched in the watershed of the Fraser, in British Columbia, and, when taken, were seeking to return to that watershed to spawn and die. It is, therefore, manifest that the catch in both the big and the lean years is the product of the same spawning-beds. The catches in the big years display the maximum product of the spawning beds—the harvest that may be reaped four years after the beds have been abundantly seeded. The smaller catches in the lean years are the natural result of a failure to seed the same beds abundantly. Provided the beds had been as abundantly seeded in the lean years as they have been in the big years up to 1913, they would have produced as abundantly. Since the spawning beds were abundantly seeded both in 1905 and 1909, the catch in those years represents the proportion of the total run that was in excess of the number necessary to stock all the beds.

Beyond any question, the catch in 1913 was the product of the abundant spawning of 1909. Notwithstanding the fact that the catch of 1913 was very much greater than that of any former

season, investigation demonstrated that a sufficient number of the fish escaped capture and passed up the Fraser River that year to have stocked all the beds as abundantly as they were stocked in 1909 *had they been permitted to reach them.* The catches of 1909 and 1913, great as they were, were not made at the expense of the capital stock, of the foundation of the run. The catches made in those years disclose the vast numbers that may be safely taken from every year's run when the beds are abundantly seeded.

The catches in recent lean years, have grown less, because they were made at the expense of the fish necessary to seed the beds. The catches in those years are in excess of the number that may be taken without endangering the supply of the stock fish. They have been an overdraft on the runs of the future. The runs can neither be maintained nor built up under such conditions. If, for a period of lean years, all the fish which return from the sea were permitted to reach the spawning-beds and there spawn, the runs in those years would eventually reach the proportion of a big year. It is simply a matter of conserving the brood stock, of seeding the spawning beds.

The salmon industry does not depend upon the amount of money invested in canneries, gear, and boats. It depends upon the number of salmon which escape capture and successfully spawn. The perpetuation of the run depends upon the numbers which escape capture. The fish which are caught and canned are not factors in future runs. The fish that escape capture and reach the beds and spawn there, are the stock-in-trade. The run four years hence depends upon their spawning. If the catch is not confined to that proportion of the total number of fish in the run that is in excess of the numbers necessary to seed the beds, it is made at the expense of the capital stock of the industry. If the catch is in excess of that number, it is made at the expense of the runs of the future. It is an overdraft. The catches in the lean years in the Fraser River district have long been made at the expense of the brood stock. A decline in the catch of any year is a matter of passing moment if it can be shown that the number of fish which reached the spawning area was sufficient to seed the beds. A decline in the number which spawn is a much more serious thing, for it foretells future loss.

For the last decade and more the record of the pack of sockeye salmon in the Fraser River district and the reports from the spawning beds of the watershed of that river leave no shadow of doubt as to the depletion of the runs in the lean years. It is difficult to see wherein more proof of depletion, save the final one of commercial

extinction, could be adduced. The results of excessive fishing which were first manifested by the sparsely covered spawning-beds of the Fraser watershed are now more forcibly called to attention by the reduction in the size of the pack.

For the past fourteen years, the reports of the British Columbia Fisheries Department have called attention to the conditions on the Fraser River spawning beds which forecasted the depletion of the runs of the lean years. The report of that Department in 1913 forecasted the decline in the run of 1917. Year after year, since 1902, it has been shown that, with few exceptions, the greater proportion of the vast spawning beds of the Fraser watershed have been but sparingly seeded in the lean years; that not enough fish reached those beds to maintain subsequent runs.

**History of the Fishery** The history of the fishing in the Fraser River district in the past fourteen years is a record of depletion, a record of excessive fishing in the lean years, a record of failure on the part of the authorities of the state of Washington to realize the necessity of conserving a great fishery, notwithstanding convincing evidence submitted to them by agents of their own creation that disaster was impending to one of their great industries.

The Canadian authorities, on the other hand, have, by their representations and acts, evinced, in unmistakable manner, their willingness to deal squarely and adequately with conditions that foretold depletion, and to join with the state of Washington or the United States Government in legislation to prevent it.

Throughout the negotiations with the Canadian authorities and those of the state of Washington the former have urged the passage of restrictive measures for both provincial and state waters. Following the investigation of 1905 of a joint commission representing the Dominion of Canada and the Governor of the state of Washington, the former approved the unanimous findings of that body, and passed, as recommended, an order in council which suspended all sockeye fishing in the Canadian waters of the Fraser River district during the years 1906 and 1908, conditional upon the Legislature of the state of Washington passing an act of like nature for her waters. The Legislature of the state refused to pass such an act, whereupon the Dominion order in council was rescinded.

**Canada Has Done Her Part** In 1908, Great Britain and the United States 'recognizing the desirability of uniform and effective measures for the protection, preservation, and propagation of food-fishes in waters contiguous to the Dominion of

Canada and the United States,' convoked a convention for that purpose, and appointed an international commission, consisting of one person named by each government, to investigate conditions and prepare a system of uniform and common regulations for the protection and preservation of food-fishes. That commission agreed upon a uniform system for the protection, preservation, and propagation of the salmon in the Fraser River district. The Canadian Government promptly approved the finding and announced its willingness to adopt for her waters the regulations recommended. The Senate of the United States, after years of delay refused approval, and the convention was terminated. Canada's record on this vital question is clear and unmistakable. She has been, and still is, desirous of maintaining and building up the runs of salmon to the Fraser. The record of the state of Washington in this respect is one of inaction. Unfortunately, Canada alone cannot preserve the fish. Until such time as the authorities of the United States or the state of Washington indicate by their enactments their willingness to meet the issue there is no relief in sight, and the runs to the Fraser river will continue to be decimated.

United States  
Suffers

The failure of the state of Washington to recognize the necessity for and the advantages that would follow the suspension of sockeye fishing in the lean years in her own and the provincial waters of the Fraser River district is a reflection upon her business foresight. Her proportion of the catch of sockeye in each of the last three big years (1905, 1909 and 1913) has averaged 1,399,808 cases per year, of an average value of \$11,198,464. Her average in each of the last six lean years has been 182,091 cases per year, of an average value of \$1,456,728. The average value of her catch of sockeye in the big years up to 1917, exceeds the average value in the lean years by approximately \$9,741,736 per year. Since, as has already been stated, the catches in both the big and the lean years are the product of the same spawning beds, it is evident that those spawning beds would have produced on the average as great a run in the lean years as they produced in the big years provided they had been as abundantly seeded. It is simply a question of seeding. The failure of the United States and the state of Washington to join Canada in measures to insure seeding those beds every year as abundantly as in the big years has, in the three lean years of the last four-year cycle, entailed a loss to the state of Washington alone of \$29,225,208. If the state of Washington would unite with the Dominion in the adoption of joint regulations that would ensure an abundance of fish reaching the spawning beds every year—years in which there

can be little profit to those engaged in the industry—there can be no question of the result. Provided fishing in the lean years is suspended for a sufficient period, the number of sockeye that reach the spawning beds would approximate the number of former big years. The ultimate return from such a measure would be so great that it is difficult to understand the failure of those most concerned in the industry to secure the necessary legislation in the state of Washington.

Turning from a consideration of the runs in the lean years to that of the run in the big years, we find that the report of the Fisheries Department of British Columbia for 1913 affords the basis of an intelligent conception of the conditions on the spawning grounds of the Fraser river, which, in that year, caused the decline in the catch in 1917. The reports from the spawning grounds contained in the report for 1913 demonstrate that the numbers of sockeye salmon which passed up the Fraser river that year were as great as in any previous big year of which there is record and possibly even greater. The capital stock of that year's run was not overdrawn even by the great catch of that season. In June, the adult sockeye made their appearance in the cañon of the Fraser, above the town of Yale and, during the high water of June and July, large numbers passed through the Quesnel and Chilko lakes at the head of the watershed. The greater proportion of the run of sockeye that reached the cañon at Yale in late July and during August and September were blockaded there by rock obstructions placed in the channel incident to railway construction, with the result that few of them were able to pass through the cañon during that time. The blasting of temporary passageways enabled a large proportion of the October and November sockeye run to pass through the cañon and spawn in Shuswap and Seton lakes. In August, sockeye were seen drifting down stream, between the cañon and Yale; which movement was very pronounced in September, and continued until the middle of October. The streams which enter the Fraser between the cañon and Agassiz were filled with sockeye from the middle of August until the end of October, while they had not been observed in those streams in previous years. Very few sockeye spawned in any of these streams; most of them died without spawning. Vast numbers of dead sockeye, which had died without spawning, were found on the bars and banks of the Fraser between Yale and Agassiz in September and October.

The number of sockeye which reached Quesnel lake in 1913 was little more than one-eighth of the number which entered that



#### HELLGATE, AFTER THE ROCK SLIDE

Showing rapids up which the spawning salmon could not ascend. Prior to the rock slide, the fish could go up the river without difficulty.



great lake in 1909. The number which entered Chilko lake, the second largest lake in the watershed of the Fraser was equally small. The summer run of sockeye to Shuswap, Adams, Seton, Anderson and other large lakes in the Fraser watershed above the blockaded cañon, was very much less than in any former big year, and the October and November run was also far less. The run in 1913 to Lillooet and Harrison lakes, through the tributary which enters the Fraser below the blockaded cañon, was not greater than in former big years, showing that the blockaded salmon did not drop down stream and spawn in these lakes. In summarizing conditions on the spawning beds, the writer, in the Provincial Fisheries Report for 1913, said, "These facts, in my opinion, warrant the conclusion that the number of sockeye which spawned in the Fraser River watershed this year was not sufficient to make the run four years hence even approximate the runs of either 1905, 1909, or 1913."

It may here be noted that the rock obstruction which prevented the late July and the August and September run of sockeye salmon from reaching suitable spawning grounds in 1913 was all removed in 1914-15. In all, a total of 225,000 cubic feet of rock was removed at a cost of \$120,000. The old channel of the river was fully restored. The salmon which reach there now have no greater difficulty in passing through the cañon than in years prior to 1913.

Had the slide of 1913 shut off the run of an off year the damage would have been slight, because, as already shown, the number of fish which reach the spawning area in the off years is small.

It was little less than a calamity that the rock slide, which so nearly destroyed the run of 1913, should have occurred in a year of the big run. The destruction of the spawning run in the Fraser in 1913 is the greatest disaster that has been recorded in the history of the fishing industry of the world. So far as the writer is informed, it has had no parallel. Estimated on the valuation of the pack of that year, the loss to the fisheries of the province of British Columbia in 1917 alone, is in excess of \$8,000,000 and the loss to the state of Washington is in excess of \$19,500,000, a total loss to the packers of that district of \$27,500,000.

Furthermore, the loss will not be confined to 1917. It will be repeated every fourth year, until such time as the governments of Canada and the United States by united efforts, drastic and long continued, shall succeed in repopulating the spawning beds of the Fraser river with the millions of adult sockeye that spawned there every fourth year up to 1913; for not only was the catch in 1917, 1,944,731 cases, or 81 per cent, less than in 1913, but, in 1917, the

spawning beds were virtually unseeded. So great a proportion of the run that sought the Fraser watershed in 1917 was taken by the fishermen that the spawning beds were no better seeded that year than in recent off years. The result of the spawning cannot produce greater results in 1921, than were produced by the spawning of 1913, and there can be little hope that it will produce a result even approximately as great.

**Drastic Joint Action Needed**

Such statements should bring a realization of the extent of the remedial measures that must be adopted if the runs to the Fraser river are to be restored. How can the salmon be brought back? There have been, and there will continue to be, many suggestions as to how this may be accomplished, but all of them that fall short of closing the district to fishing for a long period of years,—years including many four-year cycles—will fail to produce the equal of the runs of 1901, 1905, 1909, and 1913. This remedy cannot be applied by one government. Neither Canada nor the United States alone can accomplish it. There must be joint action. The figures showing the catch in Canadian and United States waters of the district set forth in the opening paragraphs of this paper, may be recalled to show the proportionate interest that each government has in the salmon fishery of the Fraser-bred fish.

Immediate joint action on the part of Canada and the United States looking to the restoration of the run of salmon to the Fraser river is imperative. The longer it is postponed the longer it will take. I venture the opinion that no other fishery question on this continent is of such importance. Certainly in no other fishery can so much be accomplished if an adequate close season is instituted and maintained.

### DISCUSSION

**DR. ROBERTSON:** Mr. Babcock has impressed on me, as a private citizen, the absolute necessity of regulating the catch in the Fraser River district.

The fish did not get to their spawning grounds. The magnitude of the disaster which has followed will, I think, make the Government realize the necessity of seeing that the fish get to their spawning grounds. I take it that there is no limit to the spawning places in the north; and the limit we put on our catch is the limitation on the number of fish that may reach the spawning grounds, so that those grounds may be properly seeded.

Mr. Babcock is willing to answer questions, but before we ask any, Lt.-Col. W. P. Anderson, Chief Engineer of the Department





SKUZZY RAPIDS

of Marine, might be able to supplement what Mr. Babcock has said.

Lt.-COL. ANDERSON: I had not the slightest intention of speaking, although I happened to be in British Columbia in 1913, and was asked by the Department of Fisheries to look into the question of the landside, from an engineering point of view.

The slide came from a cliff on the south side of the Fraser river, and was caused by the Canadian Northern railway building a tunnel. The tunnel took away the support from the face of the cliff and it came down in one mass causing a water-fall of about 9 feet in the river, where only a rapid had existed before. This happened at one of the narrowest parts of the river, and the water shot over the fall with such a velocity and in such a direction that the salmon could not jump it. Ordinarily, the height would not have stopped a salmon, but the velocity of the water was so great that they could not stem it. It was most interesting to watch the manœuvres of the salmon in trying to overcome that obstruction. They would coast along the shore of the river and take advantage of every little projecting point of rock or any little eddy that occurred, until they got right up to the point where no further protection was possible, and then they would make a jump for it, but would be caught by the current and inevitably carried down.

The Department was trying to help matters as much as possible by taking out the salmon in drift nets, lifting them over the fall, and dumping them into the river above. In the aggregate, a great many salmon were thus transported into the upper waters, but apparently not enough to furnish sufficient eggs.

The immense mass of rock was later blasted into comparatively small pieces and removed to the shore above, thus making the current slow enough to allow the salmon to ascend the rapids.

I would like to ask Mr. Babcock if it would not be possible to arrange matters in such a way as to make the lean years a little more productive, thus making production more uniform.

MR. BABCOCK: There is no doubt at all that if you could get as many fish on the spawning beds in the lean years as in the big years, you would get the same result. You could get the fish on the spawning beds, but you could not do it and fish as now. I have been termed a pessimist respecting the lean years and the situation on the Fraser river, because our Department has been trying, in every known way, to prevent fishing in the lean years, in order that all the fish that came into the river in those years could reach the spawning beds. There are millions of salmon on the spawning beds of the Fraser river in a big year. Over 4,000,000

sockeye went into Quesnel lake in 1909. This was ascertained by actual count of the fish as they passed through the fishway at the outlet of the lake. I believe an equal number spawned in the Chilko Lake watershed; there were millions in Seton and Anderson lakes, and over a million in Shuswap lake. The greater portion of the Fraser watershed—the available spawning grounds for sockeye—was absolutely crowded with fish in 1909. Notwithstanding that 25,000,000 were caught in that year, there was an equal number on the spawning beds. In the Chilko river below Chilko lake, I saw fish as thick as I have ever seen them in a hatching box in a hatchery. They were as thick as sheep in a corral into which you cannot get another sheep.

A MEMBER OF THE COMMISSION: And how deep were they?

MR. BABCOCK: I could not say. There were so many of them that the birds would not eat the eyes of those that were lying dead on the banks. They had eaten so many they were glutted. That indicates the supply of fish on the spawning beds.

In the lean years, the situation is very different. In 1916, in Quesnel lake, we could not get fish enough to obtain measurements and scales. *We did not catch one female salmon there in 1916.*

In 1917, approximately only 27,000 sockeye went into Quesnel lake as against 4,000,000 in 1909, and 500,000 in 1913. Catches in the Fraser River district have been lean because there were no fish on the spawning beds in the fourth preceding year. Canada, as I have tried to impress on you, has endeavoured to stop fishing. The officials sent over from the state of Washington to investigate agreed with us, but the State took no action. The Dominion Government passed an order in council closing all Fraser River fishing in 1906 and 1908, provided the state of Washington would do the same thing. The State Senate passed such a regulation unanimously, but the Assembly threw it out.

SENATOR EDWARDS: If, in these years, there were the normal numbers of fish spawning, why are not all subsequent years prolific?

MR. BABCOCK: Because there are not enough fish running in the lean years, and very few escape the fishermen. If you compare a year when the pack is 186,000 cases with a year in which it is 2,000,000 cases, you can see the enormous difference in the number of fish that were running in those years.

MR. SNOWBALL: Why?

MR. BABCOCK: They live four years. The run of a given year depends on the number that spawned four years before.

MR. SNOWBALL: The fish that were hatched in 1905 come back in 1909?



FISHWAY AROUND FALLS ON MEZIADIN RIVER

By such means spawning salmon are able to ascend rivers despite falls and rapids. This fishway is 20 feet wide and 3 feet deep at low water. Meziadin river is a tributary of the Fraser ~~NASS~~.



SPAWNING SALMON FORCED INTO MOUTH OF SPUZZUM CREEK

These fish were unable to ascend to their spawning beds on account of the rock slide due to C. N. R. construction work. Spuzzum creek is a tributary of the Fraser.



MR. BABCOCK: Yes.

MR. SNOWBALL: Why the small run in 1904?

MR. BABCOCK: The catch in 1904 was small because the run in 1900 was small and the beds were unseeded. There have always been three lean years followed by one big one. There has been much speculation as to the reason for this. It may be due to a slide centuries ago, similar to the one in 1913.

MR. SNOWBALL: But it would have to come three years in succession.

MR. BABCOCK: No. If we had not taken the slide of 1913 out, it probably would have been there yet, and the fish could not have got by. Many years ago something may have shut off access to the spawning grounds and made those years barren at a time of which we have no record.

DR. HEWITT: That would postulate the removal of that obstacle every fourth year.

MR. BABCOCK: Yes.

MR. SNOWBALL: Would the prohibition of fishing in 1921 produce a normal run again?

MR. BABCOCK: No. If we had had no fishing this year, and, if all the fish that came into the river had been permitted to get on to the spawning beds and spawn, there would still not have been as many fish on the spawning beds as there were in 1913.

DR. ROBERTSON: Would two full periods of four years each, in which no fishing was allowed, rectify the situation.

MR. BABCOCK: I do not believe that even two four-year periods will be sufficient. To bring the spawning up to the spawning of a big year's run, I believe fishing will have to be prohibited for many four-year cycles. Up to 1913, some men who studied the question said that there were too many salmon on the spawning ground in the big years.

DR. HEWITT: It looks as if the phenomenon of the big year had been wiped out and that future years will be uniform.

DR. JONES: Have you any data as to the number of fish reaching the spawning beds this year compared with the lean years?

MR. BABCOCK: The number was little larger than in the lean years.

DR. JONES: It seems to me that the preparations for catching this year, although the catch was not excessive, might have prevented many more going up than even in the last year.

MR. BABCOCK: They went after them in every way they could. At times, in 1901, the canners refused to take the entire catch, and many thousands were thrown away. The price of sockeyes

was about 10 cents each. It was 50 cents early this year, and 75 cents after they saw the effect of the slide. The pinks, which run every second year, live only two years and die. We would not use them in 1901. When the Provincial Government began to propagate them in 1903, it was ridiculed for doing it. The packers said they were a nuisance. They did not use them all in 1909. They used a good many in 1913. They paid 3 cents each in 1913, 15 cents in 1915, and 32 cents this year.

DR. JONES: Did the slide affect them in the same way?

MR. BABCOCK: Yes. It affected all that should have spawned above the cañon.

DR. ROBERTSON: Do you know if there is any difference in the success with which the fish reach the upper regions in the early part of the season and the late part of the season?

MR. BABCOCK: Not ordinarily. Prior to 1913, the fish never failed to get through.

LT.-COL. ANDERSON: If you saw the aggregation of drift nets in the Fraser river, you would wonder how any got through. There are 20 or 30 miles of nets.

MR. BABCOCK: This year, in this water alone (indicating gulf of Georgia and Fraser river) there were 2,600 gill nets fishing as hard as they could, and there was not an available point in that district (indicating Puget sound) in which they could drive a trap or use a purse seine that they were not doing so. They are now trying to use gill nets in the clear waters there. The Americans catch 66 per cent to our 34 per cent, because they have the first chance at the fish and in their waters they use traps. If we had control of the whole situation, we could soon effect a change.

MR. FOUND: I wish to say a word of appreciation of Mr. Babcock's paper. The problem, as he has pointed out, is an international one. Canada alone cannot save the situation. None of us who have been following the matter closely would be any more ready to hazard a statement as to just what length of time it will take to rehabilitate the fishery than was Mr. Babcock; but there is no question that by international co-operation it can be done. It is fortunate that we now have the United States as our ally, for it makes it easier for us to take a common viewpoint. The matter has already been taken up, and we hope it will be found possible, by international co-operation, even though drastic action will be necessary, to restore the fishery to its former condition. The gravity of the situation has been realized for years by everyone in Canada who has been dealing with it.

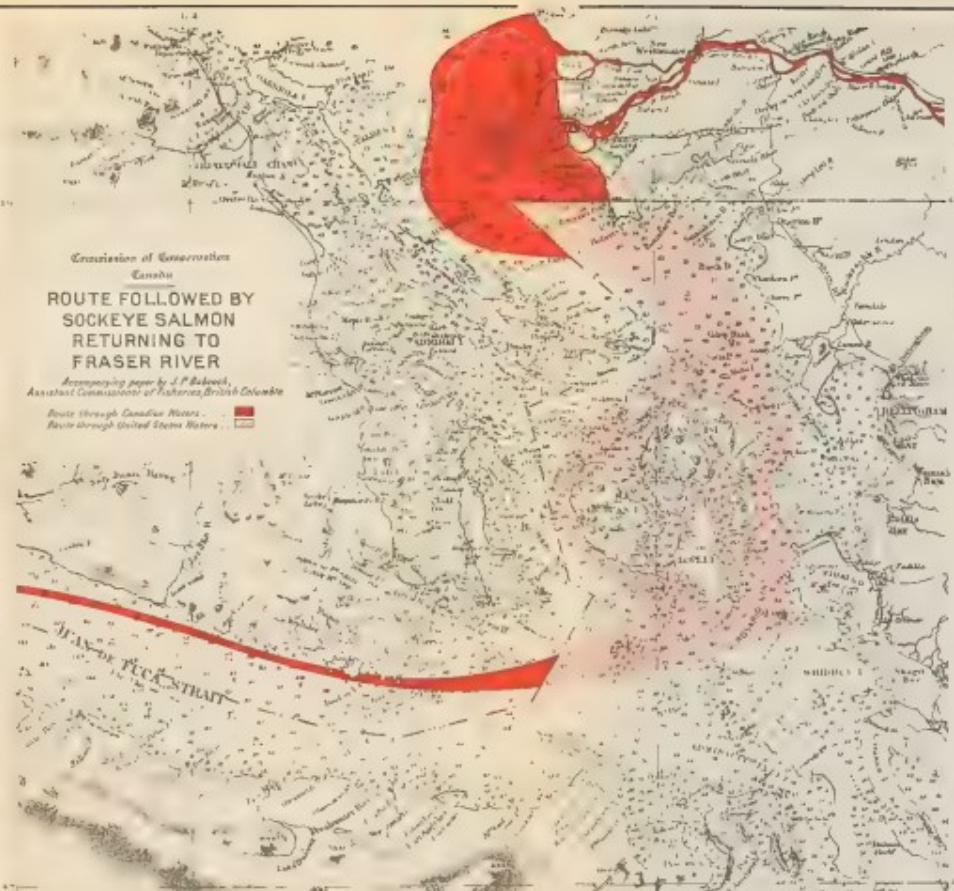
Commission of Conservators  
Canada

ROUTE FOLLOWED BY  
SOCKEYE SALMON  
RETURNING TO  
FRASER RIVER

Accompanying paper by J. P. Baldwin,  
Assistant Commissioner of Fisheries, British Columbia

Route through Canadian Waters . . . . .

Route through United States Waters . . . . .





Anyone seeing the immense amount of fishing gear in United States waters, would wonder that our own fishermen have any fish to catch at all when their turn comes. Canada has only second chance at the fish, and could, if she so desired, have followed the course the Americans have in fishing to depletion, but she has not done so, and the fishery has thus been spared.

I would not want the impression to be gained that no protection has been given. Not only has the length of net and the size of the mesh been limited, but, each week, a close time from 24 to 48 hours has been enforced, during which no nets were allowed in the water. Had fishing gone on all week in our waters, conditions would have been worse than they are.

MR. SNOWBALL: Do the same number of people fish in the lean years as in the full years?

MR. BABCOCK: Since the war, the demand has become so great that there was about as much gear in the water in 1916, as in 1917. The years 1916 and 1917 presented a great opportunity for fishermen, because the fish brought 50 cents each.

If the spawning beds are well seeded, you can confidently expect that you may have a run four years thence. It does not necessarily follow that you will because, for three years, when the fish are out in the ocean, you do not know what happens to them. There may be epidemics among them, or their enemies may be more successful in attacking them. You can seed the beds well and have a failure; but if you do not seed the beds, you cannot have a run.

There never has been an instance in which the spawning has been poor that there has been a good run four years later. That cannot be. But you may send millions of young fish down the Fraser river from the spawning beds, and then have some disaster overtake them in the sea. But, if you do not send any down from the beds, you cannot possibly have them hatched in the sea, because they cannot possibly be hatched in salt water.

MR. SNOWBALL: Have you any artificial hatcheries?

MR. BABCOCK: Lots of them, but this year we have no eggs with which to fill them.

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## Work Done Under Committees

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### Committee on Forests

MR. CLYDE LEAVITT, Chief Forester of the Commission, reported on the subjects coming within the purview of the Committee on Forests, as follows:

In 1917 notable progress has been made toward the better conservation of our forest resources. That this has been possible, in spite of the fact that legislative bodies throughout Canada have been exceedingly busy with the consideration of problems arising directly out of the war, is a guarantee that the public generally is realizing as never before the vital importance of our forest resources in peace and war alike. The fact that fully one-third of the foresters of the country are serving overseas, renders all the more remarkable the very material progress that has been made.

Much credit is due the Canadian Forestry Association for the vigorous and intelligent campaign of educational publicity which has been conducted through its Secretary, Mr. Robson Black, particularly for the purpose of securing better protection against forest fires.

### DEVELOPMENTS IN NEW BRUNSWICK

**Forest Survey** The forest survey and land classification of New Brunswick Crown lands have been continued, a total of 1,200,000 acres having been covered since the project was initiated nearly two years ago. About 925,000 acres have been covered during the year ending October 31st, 1917, at a cost of  $2\frac{1}{2}$  cents per acre for the field work alone. Through co-operation with the J. B. Snowball Company, the data secured by the Company's forest engineer have been collected in such form as to be available for the purposes of the Crown Land survey.

The demands upon New Brunswick's forests are heavy, especially for spruce for the manufacture of both paper and lumber. There is good reason to raise the question as to whether the cut of coniferous species does not now exceed the annual growth. This is one of the problems which the investigations now under way will be expected to solve, together with answering the question as to what practical measures are necessary to keep the forest area in as productive a condition as possible.

**Overtcutting  
Conifers**

The amount of annual growth upon a given area of forest land is vitally affected by the methods adopted and restrictions imposed in carrying on logging operations. On a poorly managed tract, the production may be nearly or quite at a standstill. The Government of New Brunswick wishes, eventually, to manage the provincial Crown lands on a permanent instead of a temporary basis, by harvesting each year only the equivalent of the annual growth. The vital importance of this from the viewpoint of the future is plain when it is considered that the estimated amount of spruce and balsam in New Brunswick is equivalent to only about 30 times the present annual cut of these species for lumber and pulpwood. This statement, of course, disregards the annual growth, the amount of which is purely conjectural, but is known to be much less than would be the case under good management. This only serves to emphasize the urgent necessity for increasing production and eliminating unnecessary waste. It is well known that a vast amount of material is wasted in the woods, much of which could be utilized with proper care, thus relieving to that extent the heavy demands upon the forest. Further, the coniferous species, or soft woods, are being heavily over-cut in proportion to the hardwoods. There is urgent need for the development of hardwood-using industries, to equalize the strain. To form the basis for a policy calculated to solve these various problems, is the principal object of the forest survey.

**Reorganizing  
Forest Service**

To assist further in accomplishing the same object, the Provincial Government is now considering the entire reorganization and combination under a single head, of the various lines of forestry and fire protection work. This would mean the establishment of a genuine provincial forest service, with a co-ordinated staff handling fire protection, scaling, enforcement of cutting regulations on Crown lands, and the continuation of the forest survey and land classification. It would include the handling of forest fire protection by a permanent staff supported by adequate appropriations from the provincial treasury and, presumably, assisted by assessments levied upon timber owners, as is done in other provinces. Reorganization upon this basis would mark the beginning of a new era in forest conservation in New Brunswick, and it is greatly to be hoped that favourable action will be taken at an early date.

It should be noted that the provincial authorities have already had occasion to make considerable use, on other lines of technical work, of the expert services of the foresters engaged on the forest survey, and that the valuable character of the services thus rendered

is apparently to result in a material increase in the responsibility to be placed upon the provincial forester and his staff in the administration of Crown timber lands. Already, it has been definitely decided that the Forestry Division is to assist in the supervision of the scaling and logging operations on Crown lands during the current season.

#### NOVA SCOTIA

There has been no change in the forestry and fire protection situation in Nova Scotia. The administration of the Forest Protection Act continues to give good results, and the forest fire loss during 1917 has been almost negligible.

#### SITUATION IN QUEBEC

##### Co-operative Forest Protection

The striking feature of the year's developments in Quebec has been the remarkable growth of the co-operative or association idea in forest fire prevention and control. The pioneer in this movement in Canada, the St. Maurice Forest Protective Association, has continued and strengthened its work. The territory of the Lower Ottawa association has been more than doubled through the inclusion of the Upper Ottawa drainage, extending westward to the Ontario boundary, and the name has been changed to Ottawa River Forest Protective Association. Two new organizations of a similar character have also been formed, the Laurentian and Southern St. Lawrence Forest Protective Associations. These are situated to the north and south of the St. Lawrence river, respectively, in the eastern portion of the province. The province of Quebec now has some 70,000 square miles of forest lands under co-operative fire protection. This area comprises about 80 per cent of the licensed Crown timber lands of the province, as well as a large area of Crown-granted lands. The Provincial Government is a partner in the arrangement, in each case, and contributes toward the support of the associations, in consideration of the protection afforded unlicensed Crown lands. The greater portion of the support comes, of course, from the timber owners, who are assessed on an acreage basis, by the management of the respective associations. There has been a notable increase in efficiency in the prevention of fires through educational methods, and in the prompt discovery and extinguishing of such fires as occur in spite of the precautions taken. In the construction of lookout stations, much progress has been made, and valuable experience has been gained in the development and use of pumps and other mechanical equipment



1,031 miles of old trails and canoe routes have been cleared out, and 514 miles of new trails and portages opened. Eighty-five lookout towers have been built, and some 45 miles of telephone line erected.

**Permit System Adopted** The permit system of regulating settlers' clearing fires has been put in effect in Northern Ontario, 3,886 permits having been issued during the season.

While there have necessarily been some convictions for burning without permit, the new measure has been remarkably effective, with comparatively little friction. For this, the tact and good judgment of the head office and field staff of the Forestry Branch are entitled to great credit. There is good reason to believe that the north country will not, in future years, suffer a repetition of the terrible fire disaster of 1916, which resulted in the loss of not less than 223 lives.

**Increased Value of Pulpwood** It should be noticed that the greatly increased values of pulpwood have resulted in tremendously simplifying the matter of fire protection in the new settlements of both Ontario and Quebec. This is because the settler no longer finds that he can not make reasonable wages by marketing his timber in the form of pulpwood, as was formerly the case in many of the more remote settlements. On the contrary, he finds his pulpwood a distinct asset, which it is decidedly worth his while to conserve. Therefore, there is less inclination to set fires indiscriminately or to let fires run at large.

This situation is resulting in the stimulation of settlement in the northern portions of both Ontario and Quebec. Great care must, however, be taken, lest the demand for timbered lands for settlement purposes result in the opening up of areas containing valuable timber where the soil is unsuited to permanent agricultural production. This is a real danger in all the provinces of eastern Canada.

**Supervision of Cutting Operations** It is to be anticipated that when conditions become more ripe for such action, the logic of organization will bring about the transfer to the Provincial Forestry Branch of supervision over cutting operations on Crown lands. This would permit the organization of the staff on a permanent basis and do away with unnecessary duplications, to say nothing of the all-important matter of securing more thorough enforcement of scientific restrictions upon logging operations with a view to securing the adequate reproduction of the forest on cut-over lands. It should be noted, in this connection, that foresters are now in charge of cutting operations on Crown lands in British

Columbia and Quebec and in Dominion forest reserves, exclusive of licensed lands. The proposed reorganization in New Brunswick will presumably bring all cutting on Crown lands definitely under the provincial forest service, a start in that direction having already been made. In the United States, the Forest Service has full charge of both fire protection and technical forestry practice on the National Forests. The trend toward placing these matters in the hands of specially trained men is very distinct and should be strongly encouraged.

#### DOMINION LANDS

**Improvement in Fire Laws** The principal development with reference to Dominion lands consists of improved fire legislation by the provinces of Saskatchewan and Manitoba.

In each case, provision is made for the regulation of settlers' clearing fires under the permit system, administered by provincial officials. In Manitoba, arrangements have been made whereby officers of the Dominion Forestry Branch are deputized by the Fire Commissioner to issue such permits in forest sections where such officers are available. It is hoped that a similar arrangement may be made in Saskatchewan.

**Change Needed in Alberta** In Alberta, the situation urgently demands a revision of the Prairie Fires Ordinance. The existing legislation does not fit the conditions in the forested northern portion of the province, where considerable settlement is under way. During the season just passed, for example, a number of serious fires have occurred, due to the spread of settlers' clearing fires, and much damage to forests and private property has resulted. In all of the other forest provinces of Canada, the permit system of regulating settlers' clearing fires is wholly or partially in effect, and similar action is urgently needed in Alberta.

**Crying Need for Merit System** So far as action by the Dominion Government is concerned, there has been practically no change. As indicated in previous reports of the Committee on Forests, the situation urgently demands the adoption of the merit system of appointment in the field service of the Forestry Branch and the adoption of adequate administrative measures for the enforcement of the technical cutting regulations applicable to operations on licensed timber berths, especially those in Dominion forest reserves. The Forestry Branch, a technical organization, has no administrative connection with such cutting operations, though the timber berths comprise the great bulk of the merchantable timber standing on Dominion Crown lands. Section 58 of

the Dominion Lands Act would appear to confer upon the Dominion Forestry Branch jurisdiction in such technical matters. However, if so, this provision has not been made effective as to licensed lands. Cutting on these lands is thus allowed to take place without due regard for the interests of the future, which demand that operations be conducted in such a way that the forest shall be perpetuated. The Dominion Government can take but partial credit for the practice of conservation upon its forest lands so long as this condition is permitted to continue.

It is noted with the greatest satisfaction that the Union Government is now definitely pledged to the bringing under the Civil Service Commission of all the outside services. This will be of the greatest possible benefit to the work of the Forestry Branch.

**More Reserves  
Are Needed**

It is greatly to be hoped that further extensions of the forest reserve area in the West may be made at an early date. None have been made since 1913, though very considerable areas have been found upon examination to be chiefly valuable for forest purposes.

**A Military  
Forest Reserve**

Nearly two years ago the Commission of Conservation co-operated with the Militia Department in the inspection of cordwood cutting operations on the Petawawa Military Reserve. A considerable extension of this work seemed advisable and, after full consultation, the project was transferred to the Dominion Forestry Branch, which had previously been kept in touch with the situation and had collaborated to some extent. Later, upon the recommendation of the Research Advisory Council, an appropriation of \$6,000 was made available for the establishment of a forest experiment station upon the 100 square miles of the reserve, which had been previously set aside by the Militia Department for this purpose. During the past summer, a party has been in the field making a preliminary survey of the area in question, which is almost entirely forested. A type map will be prepared and detailed studies made of volume, growth and reproduction. This information will be of great general value, since the reserve is in a district which is typical of large areas in Ontario and Quebec. The Forestry Branch is also advising with reference to the conduct of cordwood cutting operations on the reserve, with a view to securing the adoption of good forestry practice. Both the Militia and Interior Departments are to be congratulated upon this interesting and valuable development.



COMMISSION OF CONSERVATION

#### NEEDING THE FORESTER'S ATTENTION

These desirable young sugar maples have reached the stage when they should be encouraged by the removal of some of the older trees of less valuable species.



CUTTING CORDWOOD IN SECOND GROWTH FOREST ON THE PETAWAWA MILITARY FOREST RESERVE.



**Merit System  
Adopted**

In British Columbia, the outstanding development of the year has been the adoption of the merit system of appointments in the field force of the Forest Branch. This matter is referred to at greater length, under another heading.\*

**A New  
Forest School**

At the last annual meeting of the Commission, reference was made to the urgent need for the establishment of a forest school in the University of British Columbia. The University authorities have now definitely decided upon this course, but final action has been unavoidably postponed because the forester selected to head the proposed new department is engaged upon war work of an exceptionally urgent character. It is to be hoped that when this special demand is fulfilled, the establishment of the school may take place without further delay. Such a school would strengthen immeasurably the whole forestry situation in the West.

**Timber-testing  
Plant Needed**

Sight should not be lost of the need for a timber-testing plant on the Pacific coast, with facilities for the investigation of other local problems connected with the utilization of timber which it is not feasible to have handled by the Dominion Forest Products Laboratories at McGill University, Montreal. For example, if such a plant were now in existence in British Columbia, it could render an exceedingly important war service by testing timber for airplane manufacture, of which large quantities are now being secured in British Columbia. Possibly it may not be too late to secure the establishment of such a plant at Vancouver, for this purpose. Presumably, such action should come about through co-operation between the Dominion Forestry Branch and the province. The Imperial Munitions Board and the Research Advisory Council of Canada have also had this matter under consideration, and it is understood that there is an excellent prospect of favourable action.

**WOODLANDS SECTION OF PULP AND PAPER ASSOCIATION**

Of great general interest is the recent organization of a woodlands section of the Canadian Pulp and Paper Association. This section has for its objects the stimulation of interest in more economical and efficient methods of protection and utilization of raw materials for pulp, paper and lumber industries; the providing of means for the interchange of ideas among its members, and the encouragement of investigation of woodlands problems. It will thus concern itself definitely with the production of the forest crop,

\*See page 162.

just as the technical section of the same association concerns itself with the manufacture or utilization of the crop, after it is produced. This is a notable step in advance, since it involves definite recognition through specific action on the part of the private interests most directly affected, that the forest is a crop which may be reproduced time after time upon the same soil; that the rate of production of this crop may be stimulated or retarded, depending upon whether the methods of cutting are favourable or unfavourable; that the determination of such methods may be facilitated through investigation, co-operation and free discussion; and, finally, that such action is made necessary by the depletion of the most accessible supplies of pulpwood over large areas in all of the provinces of eastern Canada. It is to be anticipated that the Commission of Conservation will be able to secure valuable co-operation from the new section, in connection with the continuation of Dr. Howe's investigation of conditions on cut-over pulpwood lands.

#### THE PATRONAGE EVIL

Those familiar with the situation know that the greatest single obstacle to the efficient conservation of our forest resources has been the patronage system of making appointments in so many of our fire-protective organizations.

**British Columbia Abolishes Patronage** The first definite step, through legislative action, toward doing away with this evil in the field services handling fire protection work, has taken place in British Columbia through the adoption of the merit system, under civil service regulations. A Forest Appointment Board has been designated, upon which the lumbering interests are represented, and all appointments are based upon the results of civil service examinations calculated to demonstrate the applicant's fitness or unfitness for the position in question.

**Dominion Forestry Should Benefit** So far as Dominion lands are concerned, the Commission of Conservation has repeatedly called attention to the urgent need for civil service reform in the outside service of the Forestry Branch. Without it, the efficient protection of Dominion forests is absolutely impossible. As already noted, the Union Government is now definitely pledged in this respect with reference to all branches of the public service. The placing of all appointments in the Forestry Branch strictly on the basis of merit will prove of incalculable benefit in the administration and protection of Dominion Crown lands. The Forestry Branch should be one of the first to benefit by the new dispensation.

**Evil Overcome  
in Quebec**

In Quebec, the patronage evil in forest fire protection has been largely overcome by the organization of co-operative associations of limit holders and land owners. These associations have been assisted financially by the provincial Government, and their staffs have been deputized as officers of the Crown. Appointments are thus made on the basis of merit only, with the most satisfactory results.

**Ontario Should  
Get in Line**

In Ontario, the newly-organized Forestry Branch has been given a very free hand in the selection of its staff, and the results thus secured have been so satisfactory that the definite and full adoption of the merit system, based on civil service examinations, would seem entirely logical.

In New Brunswick, the contemplated reorganization of the forestry and fire protection work should be taken as the opportunity for definitely eliminating all considerations of patronage in appointments to the proposed new Forestry Division.

#### THE RAILWAY FIRE SITUATION

As in previous years, the requirements of the Board of Railway Commissioners relative to fire protection along railway lines have been well observed on the whole, and the loss to our forests for which the railways can be held responsible comprises but a small fraction of the total forest fire loss due to all causes.

**Less Clearing  
Accomplished**

The shortage of labour has been general and has affected the railways seriously. As a result, considerably less than in normal times has been accomplished in clearing rights-of-way of the annual growth and of inflammable material. However, patrols have, for the most part, been well maintained and railway employees have accomplished excellent results in extinguishing fires, for many of which the railways were in no wise responsible.

**Commission  
Responsible for  
Reform**

It should be noted that the Commission of Conservation was largely instrumental in securing a considerable portion of the legislation upon which this work is based\*, and has, during the past six seasons, co-operated effectively with the Railway Commission in its administration. This relationship has brought the Commission into direct contact with all the forestry and fire protective organizations throughout Canada, in a way which would have been impossible otherwise, and this contact has been of the greatest possible value in furthering the work of the Committee on Forests.

\*See also page 9.

**Government Railways**

The jurisdiction of the Railway Commission now extends to approximately 85 per cent of the railway mileage of Canada. Of lines not subject to the Board's jurisdiction, the most important, from a fire protection viewpoint, are the 4,087 miles of Dominion Government railways and some 350 miles of provincially-chartered railways in Alberta. The legislative requirements with respect to these two classes are in no wise comparable to those imposed upon the Dominion-chartered, privately-owned lines. Legislation was proposed at the last session of Parliament, placing the Dominion Government railways under the jurisdiction of the Railway Commission. Favourable action was, however, not taken, and it is to be hoped that this failure will be remedied at an early date. Representations have previously been made with respect to the provincially-chartered lines in Alberta, with a view to the imposition of requirements by provincial authority substantially equivalent to those imposed on Dominion-chartered railways. These representations should be continued until the situation is adequately provided for. The lines in question run, for the most part, through the forested sections of northern Alberta, where adequate protection against fire is of the greatest importance.

**WHITE PINE BLISTER RUST****Expenditure for Eradication**

The seriousness of the pine blister disease on this continent is indicated by the fact that in the United States the Federal Government has found it necessary to appropriate, on this account, for expenditure during the current fiscal year, the sum of \$300,000. In addition, ten states of the white pine region have appropriated some \$200,000, of which more than two-thirds was expendable during the current year. In Canada, the Dominion Government appropriated \$25,000 for the year's work of discovery and eradication, supplemented by an approximately equal amount from the provinces of Ontario and Quebec, the work being handled on a co-operative basis. In each of these two provinces, some twenty scouts were busy during the season discovering and eradicating the disease where found on the white pine or on the alternate hosts, the currants and gooseberries, both wild and cultivated.

**Less Serious in Quebec**

In the province of Quebec, the occurrence and spread of this menace to our white pine forests has fortunately proved less serious than had been feared. Thus far, it has been found only in the counties of Nicolet, Arthabaska, Lotbinière, Jacques Cartier and Two Mountains, and there only on the black currant. Continued vigilance will, however,

be necessary for an indefinite period, on account of the wide distribution of the disease to the south of the international boundary.

**Serious Situation in Ontario** In Ontario, the problem is proving more serious than had been anticipated. The infection is very general throughout a radius of about one hundred miles surrounding Toronto, with the worst infections in the Niagara district. The infection in the northern counties of Simcoe, Victoria, Haliburton and Peterborough is reported as being in dangerous proximity to the pine area of the Trent watershed. Taken as a whole, the situation in Ontario is unquestionably very serious, and unremitting effort will be necessary if white pine is to retain an important place in the forests of the future. The most serious feature of the situation is the fact that the small seedlings of white pine are most susceptible to the attacks of the disease. Thus, the large areas of natural white pine reproduction are at once threatened, and the policy of planting white pine on a large scale on cut-over and burned-over non-agricultural lands is rendered of doubtful value.

**Plant Pathologists Are Needed** Competent authorities consider that it is not feasible from a practical viewpoint, to eradicate the disease from the districts already heavily infected. It is, however, believed that much may be done to control or retard the spread of the disease to areas where it is not already found and to minimize its injurious effects where its occurrence is apparently threatening the white pine forests of a given district. To this end, the most vigorous action is imperative by the Dominion Government, as well as by the Provincial Governments concerned. The continuation and extension of the co-operation previously in effect between these agencies is indispensable for the future. It is felt that the Dominion Government should provide additional plant pathologists for this work, and also for conducting investigations of other diseases of trees, especially from an economic viewpoint.

#### REPORT ON FORESTS OF BRITISH COLUMBIA

The report on the forests of British Columbia, prepared for the Commission, has been completed by Dr. H. N. Whitford and Mr. R. D. Craig, and is now in course of publication. The essential features were referred to at the last annual meeting of the Commission, and it is not necessary to repeat them. The report contains a vast amount of exceedingly valuable data relative to the extent, administration, protection and exploitation of the forest resources of British Columbia, and will unquestionably fulfil an important function in facilitating the intelligent use of these great resources.

Such wide and more intelligent use will tend directly toward the increase of the wood-using industries, on our Pacific coast, thus supporting a larger population, increasing provincial revenues, developing the country generally, and strengthening and increasing the sources of Dominion revenue from which the great war debt must ultimately be paid.

**Value of Work  
Demonstrated**

Possibly the question might be raised that work of this kind should not be undertaken during the war. The position of the Commission has, however, been that fundamental information with respect to our natural resources constitutes an essential element in preparedness for war as well as peace. The best possible exemplification of this has occurred within the last few weeks. The successful prosecution of the war demands the construction of airplanes in enormous numbers. For such construction, large quantities of wood of specific kinds and of the highest possible grade are indispensable. Sitka or silver spruce is one of the species for which a very large demand has arisen, in this connection. This spruce grows only on the Pacific coast of North America. The production from the United States is sufficient to meet only a small part of the demand from the Allies, aside from the needs of that country, and it has become imperatively necessary to increase the output of airplane spruce from British Columbia to a point never before thought possible. The Imperial Munitions Board, accordingly, requested the Commission of Conservation to furnish information as to the situation and ownership of all important bodies of this timber in Canada. By virtue of having completed the forest survey of British Columbia, the Commission was in a position to furnish the desired information at once, and there is no possible question but that this action has measurably decreased the delay that would otherwise have been unavoidable in getting under way the stimulation of production to a scale commensurate with the imperative demands of the situation. Beyond any doubt, this one service has been worth many times the cost of the whole project. As a matter of fact, the value of any service which tends measurably toward shortening the war can not be measured in mere dollars and cents.

**Airplane  
Spruce**

The supply of airplane spruce is by no means unlimited. It is found only in the lower levels, and usually forms only a small percentage of the stand in any given locality. Only the highest grade of timber can be used for airplane manufacture, so that but an exceedingly small proportion of the forest stand in any particular district can be made available for this vitally important purpose. In the southern

portion of British Columbia, it comprises only about 10 per cent of the stand where found in merchantable quantities; on the northern mainland coast, it averages about 25 per cent and, on the Queen Charlotte islands, about 35 per cent. Of the cut, however, only from 10 to 15 per cent is suitable for airplane construction. All this means simply that to secure the very large quantities of the class of material needed, the production of Sitka spruce lumber must be increased far beyond anything ever previously contemplated or thought within the bounds of possibility. Operations must be under way at many different points simultaneously, and to bring this about, specific information as to the location and ownership of all the commercially accessible Sitka spruce timber in British Columbia had to be secured.

A Distinct War Service      As it happened, the Commission of Conservation had ready to hand a far greater amount of specific information along this line than any other agency had or could possibly secure in time to meet the present emergency. Hence this unusual opportunity to render a distinctively war service, of the value of which there can be no question. The services of Mr. Craig in this connection have been particularly valuable, especially in view of his previous contact with various features of the timber business in British Columbia. The highly specialized information which Mr. Craig has acquired has been found so valuable, in fact, that the Imperial Munitions Board has requested the Commission to loan his services for further work in British Columbia, and he is accordingly now in that province for the purpose of furthering this project, upon which another forester, Mr. H. R. MacMillan, is also engaged.

#### REPORT ON FORESTS OF SASKATCHEWAN

The completion of the report on the forest resources of Saskatchewan has been seriously delayed on account of the illness of Mr. Blumer, who conducted the field investigations for the Commission. It is, however, now expected that this report will be completed at an early date.

#### SURVEY OF FOREST RESOURCES OF ONTARIO

The Commission hopes to be in a position to begin soon a survey of the forest resources of Ontario, much along the lines of the investigations already made in British Columbia and Saskatchewan, and somewhat similar to the study of the forests of Nova Scotia made at the expense of that province, but the results of which were published by this Commission.

Present Data  
Fragmentary

Only the most fragmentary data with reference to the forests of Ontario are now available to the public, and the information that exists is so widely scattered that no comprehensive idea of the situation as a whole can possibly be formed at the present time. There is, however, a vast amount of detailed information with respect to specific localities in the possession of timber owners, railway companies, government officers and others. There is reason to believe that a great deal of this information could be secured by the Commission, in the same way that similar information was secured in British Columbia and Saskatchewan, under a pledge that only totals and averages by large areas would be published, and the business secrets of the timber owner protected generally. This project will, however, require a very considerable amount of field investigation, since there are very large areas concerning which no satisfactory data can be secured otherwise. The forest area of the province is of enormous extent, and the collection of this data will be a very large undertaking. For this reason, it is to be hoped that adequate funds may be available for the project, in order that its completion may not be unduly delayed and the work in other provinces postponed indefinitely. Fortunately, the Commission has been assured of the hearty co-operation of the Ontario Government.

This project is too large for one man to undertake alone, with any hope of completing it within any reasonable number of years. Mr. Craig was to have had charge of this work, but his transfer to the airplane work of the Imperial Munitions Board will presumably be effective for not less than six or seven months, possibly more. The Commission must, therefore, consider the advisability of securing another forester, provided a suitable man can be found, to start the collection of data in Ontario at an early date, and to act as Mr. Craig's assistant when the latter's services are no longer demanded by the Imperial Munitions Board.

#### PULPWOOD STUDY IN QUEBEC

During the past summer, Dr. C. D. Howe has been engaged, for the Commission, upon an investigation of the reproduction and growth of the pulpwood species, after logging, in the St. Maurice valley, Quebec.

This study was initiated as part of a broad investigation, to determine what technical measures are necessary to ensure the perpetuation of the vast pulpwood forests of eastern Canada. This project will necessarily require a number of years for completion, since it will be necessary to place parties in the field in other portions

of Quebec as well as in typical districts of Ontario. Possibly similar work may later prove feasible in New Brunswick, although the investigations under way in connection with the present forest survey in that province will furnish at least a very considerable portion of the basic information necessary.

In connection with the investigation in the St. Maurice valley, the Commission was fortunate in securing extremely valuable co-operation from the Laurentide Company, whose forester had previously collected a large amount of information bearing on the project. The Quebec Forest Service has also furnished some co-operation, and a very considerable extension of this is assured for next year, assuming that funds will be available for the continuation of this project by the Commission.

**Hardwoods Becoming Dominant** Dr. Howe's investigation shows that while the coniferous species comprise about two-thirds of the forest numerically, the proportion is practically reversed in the section of the St. Maurice valley investigated, when we consider the relative space occupied in the crown cover by the conifers and hardwoods. That is, the hardwoods monopolize the light to the extent of about two-thirds, while the softwoods fill but one-third of the crown cover. Thus, the hardwoods are biologically dominant, and this dominance is constantly being increased by the fact that practically all of the cutting is of the coniferous species, principally spruce and balsam. Practically no utilization of hardwoods has yet been found feasible on account of the heavy loss due to sinking when the logs are driven down the streams and lakes.

This region was first lumbered lightly for white pine squared timber between 50 and 60 years ago; then, more closely for white pine and spruce sawlogs about 30 years ago. Since then, practically the whole area has been cut twice, and some of it three times, for sawlogs or pulpwood or both.

The object of the investigation was to determine the condition of these cut-over lands with respect to the regeneration and rate of growth of the present pulpwood-producing species, namely spruce and balsam, with a view of estimating the future crop.

**Using Up Capital** The results of the investigation show that the optimistic attitude of lumbermen and limit holders in regard to the reproducing power of this type of forest is not justified. The good yields of pulpwood material at the end of each of the several cuttings in the past 30 years do not represent the amount of growth accrued during the intervals between cutting periods, but are obtained by cutting successively smaller trees, and, in general, lower grade material, and also by including a

larger proportion of balsam in each cut. For example, the spruce stumps were measured and classified according to the age of the cutting on sample plots, totalling 50 acres, and the results are here stated: In cuttings from 15 to 20 years old, the average diameter of the stumps was 15 inches; cuttings 10 to 15 years old, 12 inches; while in cuttings less than 10 years old, the average diameter was 11 inches. This shows a reduction of 4 inches in the average diameter of the trees taken within the past 15 to 20 years. The actual reduction, however, is doubtless greater, since the measurements record the present diameters of the stumps without making allowance for reduction in size by decay in the past two or three decades.

The tallying of the stumps on the sample plots showed the following increase in the proportion of balsam cut for pulpwood: On areas lumbered earlier than 15 years ago, no balsam was cut. In cuttings from 10 to 15 years old, 65 per cent and 35 per cent, respectively, were spruce and balsam. In cuttings 5 to 10 years old, 45 per cent of the stumps were spruce and 55 per cent balsam, while in cuttings less than five years old, the proportion is 22 per cent spruce to 78 per cent balsam.

Potential Pulpwood      So far as numbers are concerned, this culled-over forest is well supplied with young growth of potential pulpwood material. The condition of the average acre is represented in the table below:

|             | Seedlings<br>(trees up to<br>1 in. diameter) | Saplings<br>(1 in. to 4 in.<br>diameter) | Poles<br>(4 in. to 8 in.<br>diameter) | Trees<br>(over 8 in.<br>diameter) |
|-------------|--|--|---------------------------------------|-----------------------------------|
| Spruce..... | 635  | 99                                       | 30                                    | 6                                 |
| Balsam..... | 3,972  | 161                                      | 59                                    | 6                                 |

The casual observer is in danger of being misled if he bases his prediction of an abundant future crop of pulpwood upon the number of young spruce and balsam trees beneath the forest. The amount of future pulpwood material, and the time of harvesting the crop, depend as well upon the rate of growth exhibited by the young trees now present.

Rate of Growth      Over 2,000 trees were analyzed to determine their rate of growth in diameter, height and volume.

While the results of this study have not yet been tabulated, they have gone far enough to justify the statement that within the forest type under consideration, it takes about 40 years for the little spruce trees to acquire a diameter of one inch; 100 years to make a six-inch tree, and 150 years to reach the minimum diameter

limit of 12 inches, established by the cutting regulations in Quebec, for white and black spruce. Balsam grows somewhat faster. A one-inch tree is made in about 16 years, and it takes in the neighbourhood of 70 years to reach the Quebec diameter limit of seven inches at two feet from the ground.

These statements refer to the time required, under the given conditions, to make a merchantable forest from the seedling stage onward. It will be seen from the foregoing table that there are 30 spruce and 59 balsam trees from 4 inches to 8 inches in diameter already present on the average acre. They will furnish another crop of pulpwood material in time, but here again the time is long. The growth tables show that it will require about 70 years for the 4-inch trees and about 50 years for the 8-inch trees to reach the 12-inch diameter limit. The larger balsam, however, will be merchantable in 10 years or less.

Cuttings Must  
Be Delayed

There are only six spruce and six balsam trees over eight inches in diameter, on the average acre in this culled forest. This number is too small to justify exploitation alone, so that the next cutting must be delayed until a sufficient number of the smaller trees reach merchantable size. Just how long this will be can not be determined until our figures are more completely digested, but we have certainly gone far enough to disprove absolutely the frequent assumption that such lands can be cut over every 20 years and the same amount of material secured as before. On these heavily-culled lands, it will probably be found that, henceforward, a period of from 30 to 60 years must elapse between cuttings, if only spruce and balsam are to be removed.

It is, of course, obvious from the foregoing that one of the fundamental problems most urgently demanding solution is some method of utilizing the very large quantities of hardwoods, principally yellow birch. If these could be removed, the rate of growth of the spruce and balsam would be accelerated, since the heavy overhead shade would thus be greatly diminished, making more light available for the pulpwood species. As long, however, as the tendency of every cutting operation is to convert the area more and more into a hardwood forest, as is now the case, the problem is exceedingly difficult, if not wholly impossible, of practical solution. Much further investigation will, of course, be necessary before final conclusions can be drawn as to what modifications are necessary in the silvicultural treatment of these forests, which have now become so valuable.

**Committee on Fisheries, Game and Fur-bearing Animals**

In reference to the activities of this Committee in 1917, see page 204.

**Committee on Lands**

Mr. F. C. Nunnick reported on the work done under the direction of the Committee on Lands as follows:

The work of the Committee on Lands during 1917 has included the following—

- I. The conducting of work in Dundas county in pursuance of the plan approved at the last Annual Meeting.
- II. Assisting in land classification work in the province of New Brunswick.
- III. An investigation of conditions found in a district in southern Saskatchewan locally known as the 'Burn-outs.'
- IV. An investigation of farm water supplies in the Bechard and Yellow Grass districts of southern Saskatchewan.
- V. General publicity work.

**ILLUSTRATION COUNTY WORK**

The services of the Agriculturist have been directed to the advancement of illustration work in Dundas county along the following lines:

1. SYSTEM AND METHODS OF FARMING: including planning, rotation of crops, seed selection, variety selection, adequate seeding of clover, cultivation, live stock and use of manures.
2. FARM LABOUR, MACHINERY AND EQUIPMENT.
3. BUSINESS METHODS: in selling, buying, and co-operation.
4. PUBLIC SERVICES: such as railways, roads, telephones and rural free mail delivery.
5. EDUCATIONAL WORK: through schools, school gardens, home gardens, boys' and girls' clubs, and school fairs.
6. PROMOTION OF INTELLECTUAL, social, moral and ethical progress.

System and  
Methods of  
Farming

In the early spring of 1917, the Agriculturist made definite arrangements with a number of farmers in Dundas county to conduct work on their farms which would illustrate better farming methods. Sixteen farms were chosen for the work, four in each of the four townships, and the owners agreed to co-operate with the Committee on Lands.

The Agricultural Survey conducted in Dundas county during 1916 showed great need for more attention to seed and variety selection. Accordingly, selected seed of standard and approved varieties of grain, potatoes and corn was sown on each farm. On each of a number of the farms, two or three varieties of each of the above mentioned are being tried with a view to ascertaining which is most suitable for each farm and the immediate vicinity.

On each farm, light and heavy seeding of clover is being tried, and northern grown seed is being experimented with as against the seed commonly sown. On the farms where seed is grown, the home-grown seed is being tried by the side of the others mentioned. Various methods of cultivation are being practised and smother crops are being used for suppressing weeds.

Lime has been applied on one acre of each of five farms, but the results will not be appreciable before the spring of 1918.

Each farmer has been encouraged to give more attention to the kitchen garden. The best varieties of garden vegetables were grown under the direction of the Agriculturist, and many of the farmers have stated that this was the first season they had ever had a really successful garden.

**Labour** There has been a labour shortage in Dundas county, but it has not been so acute as in some parts of Ontario. The farmers have been induced, wherever possible, to adopt labour-saving methods. Three-horse and four-horse teams and wider implements are being used, while some of the farmers co-operating with the Commission have used tandem implements, such as harrows attached behind the roller to which four horses driven by one man, were hitched.

**Business Methods** The Agricultural Survey of 1916 showed that only one per cent of the farmers followed a complete method of farm accounting. Each of the sixteen farmers co-operating has undertaken to keep systematic farm accounts, the results of which will prove very illuminating. Co-operative buying and selling are being encouraged. There has this year been organized in the county a Holstein Breeders Club. It is the intention to hold co-operative or community auction sales of pure-bred stock, thus affording the small breeders excellent facilities for disposing of surplus stock. Negotiations and plans are under way for the organization of a county stock show and a sale (all breeds) to be held each spring. This will greatly encourage breeders to give the stock better winter care in preparation for the co-operative sale.

**Public Services** Telephones and rural free delivery are common throughout the county, but the roads, as yet, are in poor shape. Arrangements are, however, being completed for about 130 miles of good roads for the county under the Ontario good roads system. Announcement has also been made of the intention to construct a provincial highway to run north from Morrisburg through the county and on to Ottawa, but the plans for this are still under consideration. It is not likely that the construction of a considerable mileage of these roads will be undertaken until after the war.

**Educational** The teaching of agriculture in the rural public schools of Ontario is optional with the teachers. Prior to 1916, very few teachers gave instruction in the subject. During 1917, the number was increased until agriculture was being taught in 76 of the 78 schools of the county.

Twenty-eight teachers from Dundas took the teachers' short course in agriculture at the Ontario Agricultural College at Guelph during the summer of 1917, while 13 was the largest class from any other county in Ontario.

Four very successful rural school fairs were held in September. This is the first year that every township in the county has been organized for school fair work.

The number of home gardens and school gardens in the county is increasing. The Agriculturist of the Commission has attended and assisted at each school fair held and has on two occasions addressed the teachers on the need for more agricultural training in the public schools.

**The Social Side** The 'get-together' spirit has been encouraged in many ways. In June, an automobile excursion from Dundas county to the Experimental Farm at Ottawa was organized, about 50 cars conveying over 200 farmers and horticulturists. The authorities at the Farm served dinner to the visitors. A live stock parade was held for those interested in stock, while others visited the several departments and were given instruction in whatever interested them most.

During the second week of July, six meetings were held in various parts of the county under the auspices of the Commission. Dr. Robertson, chairman of the Committee on Lands, attended and addressed four of these meetings. Two meetings in the interests of horticultural matters have been addressed by the Agriculturist. There is a wide-awake Horticultural Society at Winchester and

plans are now being made for the organization of a society in Morrisburg. A tractor demonstration was held at Chesterville on October 31st, where many farmers were given an opportunity to see farm tractors at work ploughing heavy sod land.

Letters from  
Farmers

The following extracts from letters received from a number of farmers in Dundas county who are conducting practical work on farms in co-operation with the Lands Committee of the Commission of Conservation, will illustrate the nature of the work being done and the results of the work of the first year:

ORRIN STRADER, BRINSTON, ONT.: "I sowed 10 lbs. of clover seed to the acre on 5 acres, and 3 lbs. per acre on the balance of the field. The results are 50 per cent better on the part sown 10 lbs. to the acre, and I think it will stand the winter much better, as it has made a shelter for itself. Judging from this experiment. I am of the opinion that 10 lbs. to the acre should be sown at all times.

The Banner oats, which were sown  $2\frac{1}{2}$  bus. to the acre, have proved a splendid variety. I cannot tell how much per acre they will yield, as we have not threshed them yet, but I am well pleased with the crop.

The Green Mountain potatoes yielded 22 bus. from 90 lbs. planted and the Irish Cobblers, only  $9\frac{1}{2}$  bus. from the same quantity of seed. They were planted side by side. Undoubtedly, the Green Mountains are most suitable for us."

DURHAM WELLS, WILLIAMSBURG, ONT.: "Both in straw and grain, the Banner oats supplied by the Commission gave a much heavier yield than my own oats. The mixed grain grown from your seed produced plumper grain, but about the same quantity of straw as that grown from my own seed. I am much interested in the seeding down of this field. I sowed the seed as directed by you, 1 acre with 10 lbs. of northern-grown clover seed and 8 lbs. of grass seed; 1 acre with 10 lbs. of clover seed grown by myself and 8 lbs. of grass seed; 1 acre with 10 lbs. McDonald's clover seed and 8 lbs. of grass seed; 1 acre with a thin seeding, i.e., with 8 lbs. of a mixture of clover and grass seed, which is my usual seeding. This autumn, the thin seeding has a much thinner stand than the thick seeding. It will be interesting to see how this field comes out next summer.

In another 5-acre field I sowed 1 acre with 1 bus. of vetches and 2 bus. of oats; 1 acre with 1 bus. of peas and 2 of oats, and 3 acres with wheat, oats and barley. Now this field was sowed in place of another five acres of meadow that would have been pastured. This mixture became very rank, as you remember, so we only pastured one-half of the field, fencing off half, and cutting the other

half for green feed for winter. Now this  $2\frac{1}{2}$  acres furnished my main pasture for the months of July and the best part of August, raising the yield of milk from my 12 cows to 35 lbs. above normal, and maintaining it a month or more when old pastures were very short. I saved by summer pasture 10 tons of hay, 2 loads of vetches, 6 bus. of oats, 1 load of peas and oats and 3 loads of wheat, oats and barley. In addition, I seeded the field down for meadow or pasture for next year.

The potato seed you supplied gave more than double the yield of my own seed, 90 lbs. of Green Mountains, yielding over 25 bus. and the same weight of Irish Cobblers, 20 bus.

My vegetable garden was prized very highly, giving abundance of vegetables of the very best quality."

R. K. GRAHAM, SOUTH MOUNTAIN, ONT.: "The Irish Cobbler potatoes gave a yield of 22 bus. and 40 lbs. per acre; the Green Mountains, 19 bus. and 17 lbs.; each outyielding our own variety, the American Wonder.

THOMAS JOHNSTON, BRINSTON, ONT.: "The results of my experiments have been very satisfactory. They are as follows:

Clover—5 lbs. to the acre and 10 lbs. to the acre, were sown side by side, under the same conditions. There is a very marked difference in favour of the 10-lb. seeding.

Oats—The Banner oats turned out well, yielding, I would judge, between 75 and 80 bus. from the 3 bus. of seed received from the Commission. This variety seems to be adapted to this soil.

Peas—Turned out splendidly.

Corn—Wisconsin No. 7 and Bailey turned out well, the latter being the best.

Potatoes—Green Mountains were of large size and turned out well, yielding about 18 bus. from  $1\frac{1}{2}$  bus. of seed. Irish Cobblers yielded about 22 bus. The yield would have been much larger if the potatoes had been properly cared for; owing to shortage of help, they were neglected. Irish Cobblers appear to give the best results on this soil."

SAMUEL SMYTH, IROQUOIS, ONT.: "Our oats had no smut, as they were well treated, but there was a little on the barley, which was not treated so carefully. We used O.A.C. 21 barley mixed with Ligowo oats. This makes a good early crop for harvesting before the oat crop.

One and a half bushels each of Green Mountain and Irish Cobbler potatoes yielded 17 bus. and 27 bus., respectively.

We treated them for blight, thus making the tops stay green longer."

M. JOSEPH LAUGHLIN, MOUNTAIN, ONT.: "There were some splendid results, especially in potatoes and corn, from the seed you supplied.

I had three kinds of potatoes, Green Mountain and Irish Cobbler, and my own American Wonder, planted in the same field. The yield of Green Mountains was 100 per cent better, and that of the Cobblers about 25 per cent better than the yield from the American Wonders.

The Wisconsin No. 7 corn bore more ears than any of the other three kinds—Leaming, White Cap, Yellow Dent, and Golden Glow.

A seeding of 10 lbs. of clover to the acre shows superior results to a 5-lb. seeding, but there is no marked difference between the northern and home-grown seed.

We sowed spring rye, peas and oats, for summer feed. It grew splendidly and made excellent feed."

F. FRANK DAVIDSON, WINCHESTER, ONT.: "I will try to give you as best I can an account of the work conducted on our farm this year. In every case, it proved profitable.

The Banner oats looked very nice in the field and yielded more per acre than our own oats sown in the same field.

The O.A.C. No. 21 barley gave good results, but the Ligowo oats sown with it were a little thin. The seed was all treated and there was very little smut."

The Early Bailey corn sown in drills, gave a heavy crop of stocks and was well eared. It is much earlier than Wisconsin No. 7 and the Leaming, which were sown in the same field.

One bag of Irish Cobbler potatoes yielded 14 bags of nice potatoes with no rotten ones, while one bag of Green Mountains yielded 16 bags with only four rotten tubers.

I am very much pleased with the results of the clover crop. The northern-grown seed looks fine, while the Ontario-grown is not far behind it. This was sown at the rate of 10 lbs. per acre. Seeding at 10 lbs. per acre looks much better than that sown at 6 or 7 lbs. I am much in favour of thick sowing."

ARTHUR CHRISTIE, WINCHESTER, ONT.: "During the early part of July, six acres of sod that had been pastured off short, and which was badly infested with twitch grass, was ploughed, and the sod rolled down with a roller weighted with stones. Two acres were sown to buckwheat. Unfortunately, when the buckwheat was about an inch high, a hail storm pounded out half of it. However,

the balance came on very rapidly and we harvested about 80 bushels of good grain from the two acres and, while ploughing this fall, I noticed very little twitch grass. Two acres were sown to rape in drills 30 inches apart, and cultivated three times. This rape not only produced a lot of feed for our cows, but also dealt a death blow to the twitch grass. The remaining two acres were summer-fallowed and worked with both the disc and broad shear cultivators at short intervals during the summer. We are now ploughing the whole field. We will give it a good coat of manure this winter, work it up well in the spring and plant corn in squares.

The stubble land which was not seeded to clover was ploughed after harvest, cultivated at different times as required, and again ploughed this fall. The oats and vetches which we sowed for green feed proved an 'eye-opener' to me and solved the question of summer feed for dairy cows; of course, they give best results when fed in conjunction with ensilage. Our fall ploughing is well advanced and we are looking forward to and planning for a still bigger crop next year."

#### LAND CLASSIFICATION IN NEW BRUNSWICK

During 1917, the Commission of Conservation again assisted in land classification work in the province of New Brunswick. The Forest Survey of the province is being continued. As much information as possible regarding soils is being obtained at the same time and is being plotted in upon the Forest Survey maps. The Agriculturist of the Commission spent the last two weeks of July, in company with the Provincial Forester, visiting the following districts: Cowassagget settlement, Allainville and St. Wilfrid, Beaver Brook, Canaan, Pabineau River, Elm Tree settlement, Timmus to Christopher, and Siegas Lake settlement. The work was very similar to that performed last year and which is described in the last annual report. The work this year also consisted of determining, in certain areas, whether or not sufficient agricultural land existed to warrant a detailed examination being made. A complete report was prepared and placed in the hands of the Minister of Lands and Mines of New Brunswick.

While the Agriculturist was in Fredericton, a meeting of the Provincial Forester and the newly appointed Secretary for Agriculture was arranged, at which the matter of land classification was thoroughly discussed. The Provincial Department of Agriculture hopes to place trained agriculturists in various parts of the province as instructors. This, if carried out, will mean that there will be men available in the province to carry out a policy of careful examination of all lots applied for by intending settlers.

The manner in which many of the farmers of New Brunswick till their land, or fail to till it, and the lack of attention given to farming enterprise, emphasize the urgent necessity for examining carefully into each application for land. Much of the soil is only mediocre in quality to begin with, and, if not intelligently handled, soon loses its crop-producing power, or, at least, is much weakened and impaired. A weak soil requires careful treatment from the start. If one could be certain that agriculture would continue to be the first consideration of the applicant or settler, and that he would apply himself to proper tillage, crop rotation, animal husbandry, and the making of a permanent home for himself and family, one would feel more justified in recommending for grants, land that needs proper handling to preserve its fertility, but which would soon become impoverished if not farmed intelligently.

#### THE 'BURNOUTS' OF SOUTHERN SASKATCHEWAN

The district locally known as the 'burnouts' comprises the territory around and immediately adjacent to Webster, on the Canadian Northern Ry., and Radville and Trossachs, northwest and north of Webster. The area is variously estimated, but I am told it is in the neighbourhood of 100,000 acres. The top soil has apparently been burned off in spots. These spots are irregular in shape and vary in size from six or eight feet to twelve or fifteen feet across. In these depressions, there is no surface soil and the floor is an absolute hard-pan, making it very difficult to work for agricultural purposes.

Webster was once a flourishing town, with stores, houses, restaurant, public hall, and other institutions that go to make up a typical western town, but it is now abandoned. The only person now living there is the railway sectionman, who occupies the station. Even the station master has gone. A number of the buildings have been moved southward to the town of Neptune, as there is absolutely no population to support Webster since the settlers have left. Abandoned houses and shacks are to be found over the prairies where homesteads were once taken up. These one-time dwellings are fast crumbling away. In places, one can see where the land has been broken and an endeavour made to secure a crop. Weeds are now growing on these areas. An occasional settler is to be found, but they are few in number, and are plodding away doggedly with little success, barely eking out a living.

The following extract from a letter received from the Secretary-treasurer of the municipality of Lomond gives a fair idea of the school situation:

"The farms which have been abandoned are nearly all in the districts where the land is described as 'burnouts.' There is considerable of this class of land in this municipality, about one-fifth of township 6, range 15, one-third of tp. 5, r. 15, one-half of tp. 4, r. 15 and one-third of tp. 4, r. 15. All this land has been homesteaded, and, although the settlers stayed on the land long enough to secure patents, they have since abandoned them. As an instance of this, I might direct your attention to Goose Lake School District which was organized some twelve years ago; for a number of years the attendance of that school was from twenty to twenty-five, whereas, during the past two years, there has been no school in the district."

Something should be done to ascertain whether this land can be reclaimed, and to assist those who are still endeavouring to overcome their difficulties. I understand that the Dominion Department of Agriculture has established an illustration station in the 'burnout' area, which will no doubt, assist in obtaining information. It has been suggested by some local residents that a half-section or a section be farmed by the Government and plenty of power be put on the farm to plough the land deeply. One man interviewed near Webster stated that he was breaking deeply 25 acres each year, and that, so far, he had obtained satisfactory results. He stated, however, that it was expensive work and that heavy power was needed to accomplish it. An effort might be made by deep ploughing with tractors. It might also be well to see what could be done in the way of making use of this land for grazing purposes. It would seem highly advisable that a special effort be made to bring this land into use.

#### WATER SUPPLY IN SOUTHERN SASKATCHEWAN

On June 22nd, a Water Supply Conference was held in Lethbridge, Alberta, to discuss the subject of "More and Better Water for the Farmer." There was a large attendance of farmers and other interested persons, and the conference proved very profitable. Your Agriculturist and Mr. A. V. White attended as representatives of the Commission. The Chairman of the Conference, Mr. G. R. Marnoch, who initiated the Conference and to whose enterprise and energy it owes much of its success, has informed the Commission that, as a result of the paper presented entitled, *Conservation of Underground Waters Requires Governmental Regulations*, the following resolution was passed:

"RESOLVED, that this Conference urges on both the Dominion and Provincial Governments the desirability of obtaining a full and complete log of all wells dug or drilled whether for water, gas or oil in Canada. That such information is absolutely necessary having in view location of further wells:

That analysis of water so obtained in such wells be recorded for purposes of ascertaining if such be potable or suitable for stock watering purposes:

That if, in order to obtain such laws, legislation be necessary, that the same be passed; also that regulations be passed to prevent waste of waters from flowing water wells and gas and oil wells."

While the farmers realize that there is no royal road to a water supply where no water exists, they are anxious to have all available assistance in their endeavours to discover underground water supplies. A real water problem exists in the district above-mentioned.

The supply is inadequate in the dry season of summer and is a serious handicap to the farmers. The difficulty of obtaining the extra labour needed to haul water makes the problem the more acute. Mr. A. B. Tincher, of Yellow Grass, stated that he was anxious to keep more live stock on his farm, but did not feel justified in increasing his stock until he was more certain of an adequate supply of water. He stated that, as soon as he could get the water, he would keep more stock, because he realized that the single-cropping system could not last forever, and that the farmers must go into mixed farming. Mr. Gordon Stewart, of Bechard, stated that it cost him \$700 last summer to draw water. One man with a team and tank was kept busy all summer hauling water. Mr. Stewart stated that, in 1914, a neighbour of his, Mr. L. S. Hughey, who has a large farm, spent \$4,000 for water and hauling. He also stated that from \$600 to \$900 was commonly spent on farms in that district for hauling water. Ten wells, varying in depth from 36 to 75 feet have been dug on Mr. Stewart's farm but no water was obtained. A short distance south, a number of farmers grouped together and drilled a well 1,000 feet deep and did not obtain water.

The Government is urging the farmers of the West to keep more live stock on the farms and to practise mixed-farming. The farmers are gradually going into stock-raising, but, in districts where a shortage of water exists, they are very reluctant to engage in the business, as they have experienced such difficulty even in obtaining water enough for the working animals.

An officer of the Geological Survey, Mr. J. Stansfield, visited the district this summer (1917) to report upon the water situation, but it is understood his report, which will be included in the summary report of the Geological Survey, will not be published for some little time.

The conference at Lethbridge, held on June 22nd to consider farm water supply, discussed various ways and means of obtaining

and conserving water. At the conference, the purchase of a small and inexpensive drill with which test holes might be bored was suggested. Such a drill might be advantageously employed in the Yellow Grass and Colfax district. The farmers interviewed stated that they did not want the Government to dig wells for them, but would be very glad to receive information which would prevent them digging useless wells or which would assist them in determining the suitable places to dig or drill. If the methods adopted in the Lethbridge and other districts to assist in locating water, could be repeated in the Colfax and Yellow Grass districts, it would be to the advantage of the farmers living there and would be greatly appreciated by them.

The following is an extract from a letter received from Dr. G. M. Bowman, of Weyburn:

"The particular locality referred to is on the Regina-Boundary line of the Grand Trunk Pacific. It extends practically from Colfax to Regina and from north to south, a distance of from fifteen to twenty miles. It is a particularly fine agricultural district, but the one serious drawback has been the inability of the farmers to secure a domestic water supply. Individually and collectively, they have expended, in the aggregate, considerable sums, but, thus far, no satisfactory solution has been obtained. The majority of them meet the difficulty in a very unsatisfactory manner. They simply scoop out a small hole in the ground which collects the surface water. This water is then conducted through a drain containing mechanical-filtering substances to a well, generally at the house.

"I am informed that, during 1915, one farmer living in the vicinity of Lewvan spent \$2,200 for hauling water to his stock and, as I had occasion to pass through this district a number of times that year, I know that it was a very common sight to meet teams hauling water in tanks. The Grand Trunk Pacific also hauls water to all the towns along this line for a distance of about forty miles. To me, at least, this appears to be a condition which would justify the Government in making an effort to assist in the solution of the problem. Generally speaking, the farmers in this area are well-to-do, they are not asking the Government to provide them with wells, they simply desire that the problem be solved for them if possible; they would be only too glad to provide their own wells if they knew how it could be accomplished."

#### GENERAL PROPAGANDA

About 20 meetings have been addressed by the Agriculturist in the interests of conservation and better farming.

Each of the 16 representative farms in Dundas county on which work is being done, has been visited at regular intervals of from two to three weeks during the season for the purpose of inspection and giving instruction. Immediately preceding oat harvest, each one of the 16 representative farmers was taken to visit three or four of the other farms where work was being conducted along similar lines. This proved very instructive as it gave the farmers the privilege of exchanging ideas and an opportunity to study the work and methods of the various other men visited. Articles for *Conservation* have been prepared each month. The Commission has received the cordial co-operation and assistance of Mr. E. E. P. Bradt, District Representative of the Ontario Department of Agriculture, and Mr. J. W. Forrester, Inspector of Public Schools for Dundas county.

#### Committee on Minerals

Mr. W. J. Dick, Mining Engineer of the Commission, reported on the work done under this Committee as follows:

##### Coal Situation

The most striking feature in the mining situation in Canada to-day is our dependence upon the United States for supplies of coal to heat our dwellings and keep our factories and railways in operation. In 1916, the coal production of Canada amounted to nearly 14,500,000 tons, while the imports for the same year exceeded 17,500,000 tons. In other words, we imported more coal than we produced. Of the area consuming coal imported from the United States, central and eastern Ontario is supplied *via* St. Lawrence, Lake Ontario and Niagara River ports, while that for Western Canada is shipped by rail to Buffalo and other Lake Erie ports, and, thence by water and rail to its destination.

The entrance of the United States into the war caused a greater demand for coal and made it necessary to place the sale and distribution of coal in that country under a Fuel Administrator.

In past years there has always been a carry-over of coal at the docks of the Great lakes amounting to hundreds of thousands of tons. This year there was no anthracite on hand and but little bituminous coal. This, together with a decrease of production of 200,000 tons of coal on account of the coal strike in the West, caused the Government of Canada to appoint a Fuel Controller

and to place the mines of the district, formerly under strike, under a Controller of Mines.

**A Warning  
Needed**

In the March issue of *Conservation*, the Commission published an item on the necessity of laying in coal supplies in the spring and summer instead of in the autumn. This item was re-published in more Canadian papers than any other article we have ever published, and Canada's imports of anthracite coal last summer were much larger than usual. It is, of course, a matter of inference, but it is believed this result is, in part at least, due to this article, which was also sent out to newspapers as a special bulletin to catch the attention of editors who had overlooked it in *Conservation*.

**Briquetting  
Lignites**

The Commission of Conservation has frequently pointed out the dependence of portions of Canada upon supplies of coal from the United States and has indicated measures that should be taken to ensure our needs being supplied from our own resources. It was possibly on account of their knowledge of this that the Advisory Council for Scientific and Industrial Research, when investigating the *economic possibility* of establishing a carbonizing and briquetting plant utilizing Saskatchewan lignite, applied to the Commission for information on the subject. The Advisory Council also completed an arrangement with Dr. E. Haanel, Director, Mines Branch, Department of Mines, whereby the Mines Branch undertook to investigate and report upon the efficiency of carbonizing and briquetting plants in the United States. These plants were largely of an experimental nature and a demonstration of their economic possibilities was a necessary precursor of any attempt by the Advisory Council to erect a plant. On the other hand, even if the carbonizing process were efficient, it would be inadvisable to erect a plant if the products could not be marketed at a fair profit.

As the report on the *Conservation of Coal in Canada*, published by the Commission of Conservation in 1914, contained a study of the 'market' possibilities of such plants, Mr. R. A. Ross, Convenor of the Lignites Committee of the Advisory Council, requested that your Mining Engineer be permitted to bring this report up to date in this respect. The investigation consequent on this showed that the price of United States anthracite in certain cities in Manitoba and Saskatchewan, compared with the estimated cost of carbon briquettes, is as follows:

## COMPARATIVE COST OF CARBON BRIQUETTES AND ANTHRACITE

|                           | Tons of<br>U. S.<br>anthra-<br>cite<br>used in<br>1916-17 | *Price of<br>U. S.<br>anthracite<br>per ton<br>f.o.b.† | Carbon briquettes  |   |  | Difference<br>in favour<br>of carbon<br>briquettes |
|---------------------------|---|--|--|---|--|--|
|                           |   |  | Freight<br>rate and<br>switch-<br>ing,<br>from<br>Bienfait | Esti-<br>mated<br>cost<br>f.o.b.<br>cars† | Selling<br>price,<br>profit of<br>\$1.00<br>per<br>ton † |  |
| Winnipeg....              | 200,000   | \$9.50 to \$10.00                                      | \$1.90   | \$9.15                                    | \$10.15  |  |
| Portage la<br>Prairie.... | 4,000   | 10.00 "  | 10.50  | 1.80                                      | 9.05   | 10.05  |
| Carberry....              | 1,050   | 10.65 "  | 11.15  | 1.60                                      | 8.85   | 9.85   |
| Brandon....               | 9,200   | 10.60 "  | 10.85  | 1.50                                      | 8.75   | 9.75   |
| Virden.....               | 2,280   | 10.80 "  | 12.15  | 1.60                                      | 8.85   | 9.85   |
| Moosemin ..               | 1,836   | 11.00 "  | 12.25  | 1.80                                      | 9.05   | 10.05  |
| Wolseley....              | 1,012   | 11.50 "  | 11.75  | 1.80                                      | 9.05   | 10.05  |
| Regina ....               | 45,300‡   | 11.60 "  | 12.25  | 1.60                                      | 8.85   | 9.85   |
| Moose Jaw..               | 3,845   | 11.45 "  | 12.35  | 1.50                                      | 8.75   | 9.75   |
|                           |   |  |  |   |  | 1.70 " 2.50  |

\*Owing to the exhaustion of the anthracite resources of the United States, these prices will increase year by year.

†Point of consumption.

‡Figures supplied by the Secretary, Regina Board of Trade.

Carbonized lignite briquettes and anthracite coal are stated to be practically equal in heating value. If so, the briquettes and anthracite will stand comparison very closely on the basis of cost. The foregoing table shows that the difference in favour of the briquettes as compared with United States anthracite coal varies from 45 cents at Portage la Prairie to \$2.50 per ton at Moose Jaw. If the producing plant be allowed a profit of \$1.00 per ton, briquettes could compete with anthracite in western Manitoba and Saskatchewan, though the difference in price east of Carberry is not considerable. On the other hand, every dollar spent on such fuel in preference to anthracite is a dollar retained in Canada.

Pulverized  
Fuel

The coal resources of Canada are considerable but a large proportion is unsuitable for use in the ordinary way as locomotive fuel. The coals of Manitoba, Saskatchewan and portions of Alberta are lignite or sub-bituminous coal, high in moisture, and, owing to excessive 'spark-ing' cannot be used as locomotive fuel. In 1916, over 8,675,000 tons of coal and nearly 50,000,000 gallons of fuel oil were consumed on railways in Canada. On account of our large imports of coal and fuel oil, which have recently increased in price, anything that can be done to increase efficiency in generating power from coal or to curtail the use of fuel oil by the substitution of our coal or

lower-grade fuels, which cannot now be used on account of their liability to set fires, should be investigated and introduced as soon as possible. Your mining engineer is therefore compiling information respecting the use of powdered coal and peat as a fuel for locomotives, stationary boilers, cement plants and metallurgical purposes. During the last few years, this class of fuel has been used with economic success and it is anticipated that, within a short time, it will be used to a much greater extent in Canada.

**Advisory Service** During the year, your Mining Engineer's services have been utilized by the Imperial Munitions Board, War Purchasing Commission; Contracts Branch, Department of Militia and Defence; Fuel Controller; and Honourary Advisory Council for Scientific and Industrial Research; as well as by the Technical and Industrial Committee of the Ottawa District.

**By-Product Coke Ovens** By-product coke ovens, the use of which we have long advocated, are now gradually being introduced in Canada in place of beehive ovens which waste valuable by-products such as gas, tar and ammonia. This is due largely to the increased price of the by-products on account of the war. It is reported that the Granby Consolidated Mining, Smelting and Power Company are installing 30 by-product coke ovens in connection with their smelter at Anyox, British Columbia.

**Conservation of Coal** The coal resources of a country are recognized as one of the most important assets for commercial and industrial development. The by-products obtainable from coal are numerous and important and, in certain countries, including Great Britain, the best authorities contend that it is uneconomic to burn it in the ordinary way. When burned under boilers to produce power, less than 15 per cent of the heat units in the coal is utilized. By low temperature carbonization, the valuable light and heavy oils are obtained, the gas can be used to generate power and the residuum coke containing nearly all the original fixed carbon can be burned in the ordinary way to produce heat and power.

Canada has large supplies of coal, but, owing to the lack of transportation facilities, a comparatively small proportion is now available for development and new fields can be opened up only at great additional cost. To conserve the coal in the developed areas and, also, to prevent the economic waste through the added cost necessary to develop new areas, all waste should be reduced

to a minimum. At the present time, a large proportion is lost or wasted. The waste of slack coal is small in comparison to coal left in as pillars or to the loss of whole coal seams through caving of the measures.

Dominion  
Government  
Responsible

The largest reserves of coal in Canada are situated in Alberta, Saskatchewan and British Columbia.

The unalienated coal resources of Alberta and Saskatchewan are held by the Dominion Government whose duty it is, therefore, to protect these rights for the public. The causes of waste of coal in these provinces may be classified, in order of importance, as follows:

- (1) The method of disposition of coal lands.
- (2) Loss of coal due to actual mining operations, pillars lost through crushing, etc.
- (3) Waste of unmarketable slack coal.
- (4) Waste of by-products due to the method used in coking coal.

(1) **DISPOSAL OF COAL LANDS.**—The coal-mining rights on Dominion lands are disposed of under lease by the Federal Government. The provisions of the lease are liberal and such as to encourage coal-mining. Leases are granted according to priority of location but no consideration whatsoever is given to the relation of coal seams, the quality of the coal in the several seams, the order in which seams are to be worked, or the total coal content contained in the area leased.

Wasteful  
Mining

In the coal areas of Western Canada, there are usually a number of seams quite close together, and, should the lower seams be the most desirable as to quality and ease of working, there is nothing to prevent the operator from mining them first. In fact, this practice is now being followed in a number of cases in the West. As a result, caving of the measures will, in most cases, render it impossible to recover the coal from the upper seams. Owing to the wide distribution of coal and the freedom with which leases are granted to any one desiring to mine it, the operator who looks to the future and mines the coal in a systematic manner, carries on his operations at a higher cost than his competitor who takes the easiest available coal. There is, therefore, every inducement to use wasteful methods. For instance, in a certain mine, owing to a heavy demand for coal, the directors instructed the mine-manager to produce an output greater than the development work justified. The mine-manager

was forced, against his better judgment, to obtain the coal wherever he could. Some pillars were extracted and others were reduced to such dimensions that they were not able to bear the weight of the superincumbent strata. As a result, there was a 'squeeze,' the mine was badly wrecked and much coal was lost.

All other important coal-mining countries which dispose of coal-mining rights under a system of leasehold have found it necessary to prevent waste arising from the lessee sacrificing the public wealth for his private gain and waste due to injudicious mining. Before a lease is granted or mining operations are begun in Nova Scotia, Austria, Australia and Japan and privately owned coal lands in England, Scotland, and in certain portions of the United States, it is necessary for the applicant or the holder of a mining right to submit a scheme of intended operations to the proper authorities. To receive approval, this plan must be such as to prevent wasteful mining and, at the same time, provide for the safety of the miners.

| Remedy<br>Suggested | In 1913, your Mining Engineer suggested "that an engineering authority be appointed by the Dominion Government to approve of the methods to be employed at all mines operated under Dominion Government lease, and, that the chief inspector of mines of each province be associated with this engineering authority insofar as matters relating to the operation of mines in that province are concerned. It would also be the duty of such authority to investigate all applications for leasing coal lands and to determine the conditions under which such leases should be granted."* |
|---------------------|--|
|---------------------|--|

In addition, information concerning coal lands should be collected and correlated, that additional information may be available to determine the conditions under which new leases should be granted.

Mr. George N. Rice, Chief Engineer of the United States Bureau of Mines, has made a full investigation of the Crowsnest Pass district for the Minister of Mines of British Columbia. He is of the opinion that the problems of this district, both as regards safety in mining and efficiency in mining to secure the recovery of the largest possible proportion of the coal reserves, can best be solved by the appointment of a permanent commission which should personally investigate conditions, conduct extensive tests continually, and advise operators in their work of mining. It is evident that something should be done to prevent inefficient mining even where coal lands have been disposed of outright.

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\**Conservation of Coal in Canada*, by W. J. Dick, Commission of Conservation, Ottawa, 1914, p. 4.

(2) WASTE IN ACTUAL MINING OPERATIONS.—This waste is represented by:

- (a) Non-recovery of pillar coal.
- (b) Mining of portion of seam only.
- (c) Coal lost through the opening up and subsequent abandonment of small or 'gopher' mines.
- (d) Unnecessary slack made during mining.

(a) *Non-recovery of Pillars*—In the steeply pitching and frequently faulted coal seams of the Rocky mountains, where the cover over the coal varies from zero to several thousand feet, it is difficult to recover all the pillar coal, but this waste would be reduced to a minimum if the suggested supervision of methods of mining were followed.

(b) *Mining of Portion of Seam only*—Sometimes, the seam is so thick that it is not possible to remove the whole seam at one lift and only the better portion is mined; or the seam may be divided by rock or dirt 'partings' of such a character that it does not pay to remove more than a certain portion of the seam. Thus, this might, under present conditions, be an unavoidable waste but, so far as Canada, as a whole, is concerned, it would usually be more economic to forbid the opening up of such a seam until market conditions made mining the whole seam a profitable operation.

(c) *Coal Lost Through the Opening up and Abandonment of Small or 'Gopher' Mines*—This loss has been considerable. In such mines, a tunnel is driven into a hill and the coal extracted. When the distance the coal has to be trammed increases so that too much time is occupied in hauling, the mine is abandoned and a new one opened in the vicinity. This waste would be prevented if such miners reported operations to the Mine Inspector and to the Dominion Government, and if the conditions of the lease were enforced.\*

(d) *Unnecessary Slack Made during Mining*—Slack is produced during mining and handling of the coal. The amount is reduced by the use of mining machines and by care in handling the coal.

(3) *Waste of Unmarketable Slack Coal*—In the semi-anthracite mines and in practically all the sub-bituminous and lignite mines, the proportion of coal wasted as slack varies from 12 to 35 per cent. Everything possible should be done to encourage the use of this

\*Leases issued by the Dominion Government provide that mining must be carried on "in such manner only as is usual and customary in skilful and proper mining operations of similar character when conducted by proprietors themselves on their own lands, and when working the same shall keep and preserve the said mine and works from all avoidable injury and damage, etc."

class of fuel. It has been urged that the royalty be exacted on total output and that all or a portion of the royalty on slack coal be rebated, provided it is utilized or marketed. This, however, might encourage the production of a larger proportion of slack. Under the present leasehold system, royalty is exacted on *merchantable* output only, which some authorities contend, tends to encourage the waste of slack coal.

Purchasing Coal on Specifications      No other mineral substance in the world has been bought and sold in such a haphazard way as coal. In Canada, it is purchased mainly on its reputation, or trade name, rather than under contracts specifying heating value, content of ash and moisture, and other characteristics. To utilize the coal in the most economical manner, the consumer should know what he is buying.

The Government of the United States annually expends \$8,000,000 for coal. Since 1906, it has been purchased according to rigid specifications. In recent years, the United States Government and other large consumers have appreciated more and more the desirability of determining by chemical analyses and tests the character and quality of coal deliveries. Studies of engine-room and boiler-room efficiencies and economies point forcibly to the necessity of devoting more thought to improvement there. This calls for an intimate knowledge of the character and quality of the fuel used. The analyses and tests of delivered coal furnish data whereby the power-plant results can be comprehensively studied and a continuous check maintained on the coal and on the conditions of plant operation. A laboratory is maintained at Washington by the Bureau of Mines, where samples representing deliveries of coal purchased for Government use are analysed and tested, to determine whether the coal is of the quality guaranteed by the contractor. If it is not up to standard, the price to be paid is decreased in proportion; if it is above standard, the price is proportionately increased.

The Fuel Research Board of Great Britain has recently undertaken the systematic investigation of the coal seams now being worked in that country as well as others possessing potential workable value. It is the intention, also, to carry out investigations into the nature and origin of the various types of coal. These researches will probably throw much light upon the suitability of coals of different kinds for the recovery of by-products, which have lately become so important.

Figures are not available showing the amount and value of the coal purchased annually by the Dominion Government but it no

doubt amounts to over \$1,000,000. It would seem advisable that this coal be bought on specifications similar to those adopted by the United States.

#### Press and Co-operating Organizations.

Mr. J. Dixon reported on the work done under this Committee as follows:

During the past year, the principles for which the Commission of Conservation stands have received publicity through the mediums of *Conservation*, *Conservation of Life*, the *Annual Report*, and other publications of the Commission.

**Press Publicity** The Commission is again indebted to the newspapers and other periodical publications for much valuable space given to reprinting articles from *Conservation*, and for generally furthering the objects advocated by the Commission. The larger papers have given special attention to conservation subjects. These papers, being published in the cities, and being largely dependent for power and light upon electric energy, recognize the value of water-power and what its proper conservation and development mean to the manufacturing and other industries of Canada. The acute fuel shortage in many parts of the Dominion has also directed much newspaper attention to our water-powers and coal deposits. The publicity given by the press to the recent notice of application of a private company for permission to construct a dam in the St. Lawrence river created considerable public interest. Previous to the educational work of this Commission for the conservation and public control of all water-powers, such an application for special privileges would likely have gone unchallenged.

Our editor again attended the annual meeting of the Canadian Press Association at Toronto in June last. In discussing the work of the Commission with a group of editors, the opinion was freely expressed that the Commission of Conservation was one of the most useful organizations of the Government, and its work was a credit to the men associated with it. This opinion is reflected in the amount of space the press has devoted to conservation material.

**Publications of the Commission** The Planning and Development Branch has utilized *Conservation of Life* as its medium of publicity. Valuable contributions have been made to its columns by authorities throughout Canada and its influence is being felt.

The *Annual Report* was again printed in English and French, and received many favourable notices in the press. There has been a heavy demand for copies of this report.

*Rural Planning and Development*, a report by Mr. Thomas Adams, has also been published. This volume, the first of a series of three, has been much quoted. An extract from the chapter on 'Returned Soldiers and Land Settlement' was cabled to the *Canadian Daily Record*, issued by the Canadian War Records Office to the Canadian Overseas Forces, and appeared in the issue for October 11. A report of the meeting of the Civic Improvement League of Canada, held at Winnipeg on May 28-30, has been published under the title *Urban and Rural Development*.

There are in press reports on *Fire Waste in Canada*, by J. Grove Smith, *Water-powers of British Columbia*, by A. V. White, and *Forest Resources of British Columbia*, by Dr. H. N. Whitford and R. D. Craig.

Other reports in course of preparation are *Urban Planning and Development*, by Thomas Adams; *Supply and Distribution of Electric Energy*, by L. G. Denis, *Powdered Fuel*, by W. J. Dick; and *The Wild Life of Canada and Its Conservation* by Dr. C. G. Hewitt.

War Service  
of Staff

The editorial staff is still in a depleted condition.

Mr. Baldwin, assistant editor, is still overseas, while

Mr. Donnell, assistant editor, has returned, wounded, from the front, but has not, as yet, been able to resume his office duties.

#### Waters and Water-Powers

Mr. Leo G. Denis, Water-power Engineer of the Commission, reported as follows:

Special efforts were made during the past year to secure descriptive information on electric power plants and systems throughout the Dominion for a report to be published shortly on the supply and distribution of electric energy in Canada. The importance of this subject as related to our water-power resources need scarcely be enlarged upon. Without the impulse given by the possibility of transmitting power over long distances, water-powers would not have attained the high place they now occupy among the various natural resources of a country. Long distance transmission of energy is only possible through the medium of electricity and, while some large developments, notably in the paper and pulp industry, make direct use of water-power, practically all other developments of importance are for the production of electrical energy.

**Report on  
Electric  
Plants**

The report will give a short description of all electric central station systems including power plants, transmission lines and distribution, each system being described individually. In previous reports respecting this subject, the Canadian data have been appended to United States reports and treated as secondary. Their incompleteness has created a false impression to the detriment of this country. This is simply due to the fact that complete information covering the Dominion has not, thus far, been collected. The production of electric energy in Canada is one of the developments to which we can point with pride and the data thus far received demonstrate that, in this respect, we are behind very few countries, if any.

The greater portion of the information has been collected by correspondence, under the direction of your Water-power Engineer and your Mining Engineer. The various questionnaires sent out in this connection included the following items:

**HYDRAULIC PLANTS**—Dams and hydraulic works; available head, flow of river, hydraulic troubles, power houses, turbines, generators and transformers, demand and output, interruptions to service, costs and date of installation.

**STEAM AND INTERNAL COMBUSTION ENGINE PLANTS**—Power houses, boilers, gas producers, engines and turbines, generators, fuel, costs and date of installation.

**TRANSMISSION LINES**—Location, voltage, capacity, construction, protection and substations.

**DISTRIBUTION**—Purchased energy, station transformers, output, mileage of streets covered, voltages, line transformers, connected load, street lighting, costs and rates charged.

As some of the plants, through neglect on the part of their officials, have persistently failed to forward the desired information, it has been necessary to obtain the data by a personal visit. The delinquents in the Maritime Provinces and Quebec have been covered recently in this way, and the same procedure will be followed for the remainder of the Dominion in the near future.

**Developed  
Water-powers**

Another subject receiving attention is the revision of the list of developed water-powers in Canada as published in the report of 1911. The developed water-powers are increasing in number and, as no detailed complete information has been published since the report above referred to, it seems most desirable to have the data brought up to date. The Commission is constantly receiving inquiries on various phases of this subject. From time to time, estimates of developed water-powers for the whole Dominion or for certain portions of it have

been made but these are of little value unless specific information respecting each power included in the estimates is given. The publication of a detailed list also permits any grouping which may seem desirable.

Routine work included the preparation of a number of short articles having reference to our water-power resources and also brief reports on special subjects, including possibilities of water-power sites, rates for electric energy, data on discharges of rivers, industrial statistics, certain water-powers of the Prairie Provinces, bibliography of Canadian water-powers, general water-power situation in Canada, water filtration plants in Canada, and electric energy required for various purposes.

**Coteau Dam Project** A report was prepared on the proposed scheme to dam the river St. Lawrence for the development of power at the Coteau rapid at the foot of lake St.

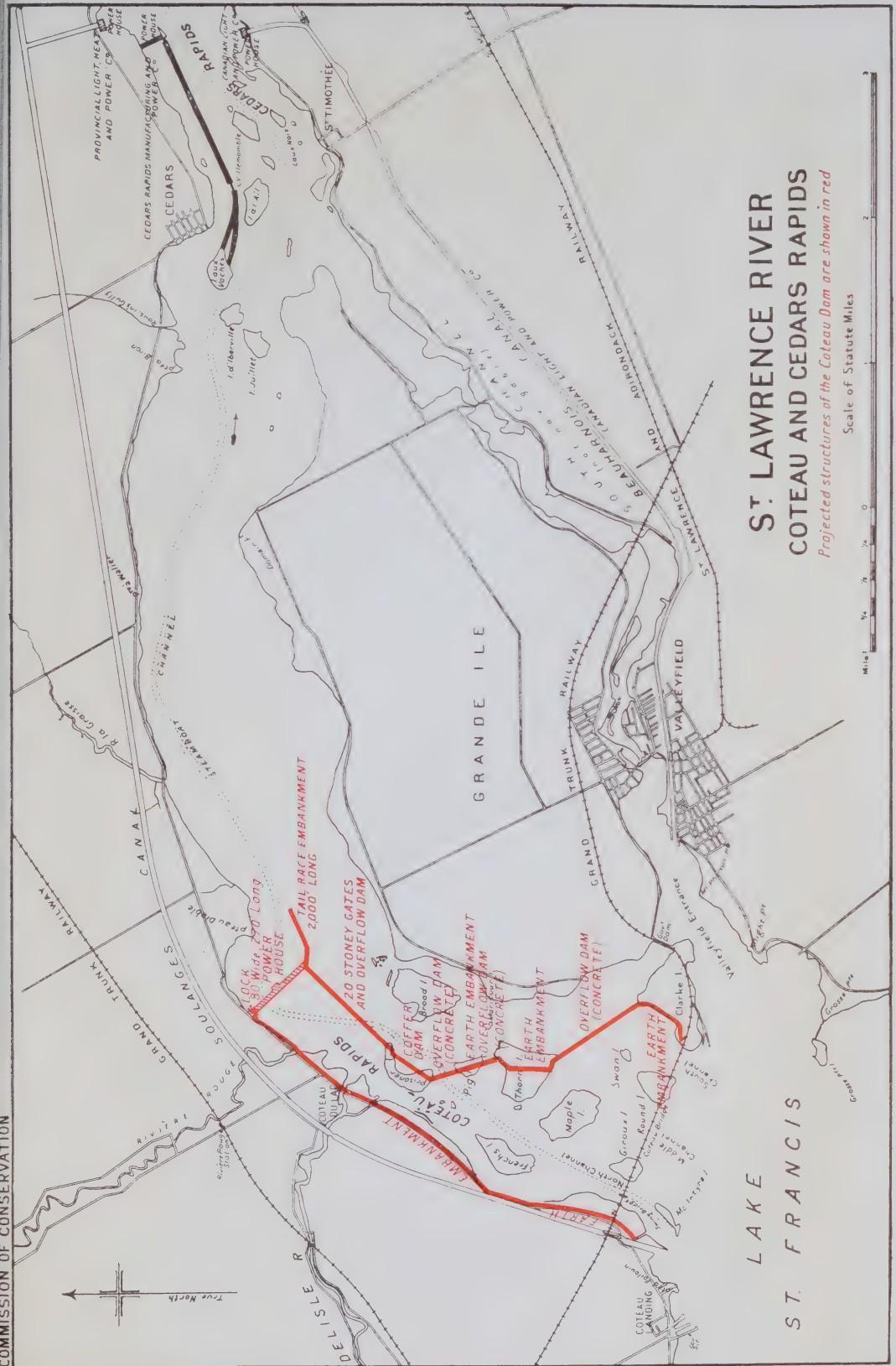
Francis.\* Apparently, the principal object of the project is the exportation of electric energy generated from Canadian water-power. Permission for such a development would be in violation of the recognized principle that no further development should be allowed on the St. Lawrence between Prescott and Montreal until a comprehensive plan of development for that portion of the river has been decided upon. The necessity of this is emphasized by the conditions at Niagara. There, the development by the Ontario Hydro-Electric Power Commission will utilize the entire head, including the lower rapids, instead of being limited to the descent in the cataract proper, as has been the case with all the power so far developed. It is also proposed to 'scrap' some or all of the existing plants which, if carried out, will involve the destruction of many millions of invested capital.

### Town Planning and Land Development

The report on this phase of the Commission's work was made by Mr. Thomas Adams, Town Planning Adviser to the Commission, as follows:

Looking back over the last three years of work of the Commission in connection with town planning and housing I think there is every reason to be gratified with the progress and achievements, although these have not been up to expectations. In comparison with other countries, our advance during the three years of war has been very satisfactory, particularly in regard to the passing of provincial legislation dealing with town planning. The

\*The text of the protest of the Commission of Conservation against this project appears as Appendix VII.



PLAN SHOWING PROPOSED WORKS OF THE POWER DEVELOPMENT CO.



preparation of schemes under the different town-planning acts is the matter about which there has been most delay as a result of the war. At the present time, local authorities hesitate to incur the small expenditure required to prepare schemes, even when convinced that by doing so they would be making a good investment.

The work of the Commission has been warmly supported in every province and our advice and help has been uniformly welcomed and, to a large extent, utilized. This is all the more satisfactory having regard to the fact that neither the Commission nor its officers have any executive power to enforce their will on any section of the community. Progress is being made in all the nine provinces.

#### NOVA SCOTIA

In Nova Scotia, the application of the Town Planning Act is being promoted in the chief centres of population. The preparation of a number of development schemes for the city and county of Halifax has been receiving a considerable amount of attention. In view of the rapid developments taking place in the city and county, it is urgent that these schemes should be advanced as rapidly as possible.

Halifax  
Scheme

I have been asked to suggest areas and submit draft schemes to the Town Planning Boards of the city and county and am proceeding with the

work. The Boards are ensured of the co-operation of owners of large industrial plants in their efforts to make good plans of development. Owing to the use of Halifax for military and naval purposes during recent years, a great deal of prosperity has come to the city. This has meant that housing accommodation has become scarce and dear. As might be expected during a time when capital is difficult to obtain for building purposes, private enterprise is not meeting the demand for increased accommodation and the consequent scarcity of a supply of dwellings is causing much overcrowding. Having regard to its causes, such a situation should not be permitted to develop without some assistance and guidance being rendered by government authorities to prevent injury to public health. Physical and moral deterioration and an increase in the death rate are the usual results of overcrowding; and it is therefore all the more to be deplored that overcrowding is so often the result of prosperous times.

The Halifax Civic Improvement League has interested itself in promoting a housing company, to meet a small portion of the demand for increased accommodation for the working classes in the city. A company has been formed and steps are being taken

to raise the necessary capital for the erection of a considerable number of houses.

**Dealing With Overcrowding**

Meanwhile the City Council and the Board of Health are endeavouring to cope with the difficulties caused by overcrowding in existing buildings and by the continued occupation of unsanitary homes. In April last, drastic legislation was passed, giving power to the Board of Health to prevent the occupation of unsanitary property. It may make by-laws to prevent the overcrowding and unsanitary condition of tenement houses, and requiring the owner, agent or lessee of any such tenement houses to make such statement or return respecting the character, occupation, rentals or other matters and particulars respecting such tenement houses as the Board deems fit. In place of ordering any premises to be vacated, the Board may in its discretion "declare such premises to be in an unsanitary condition and that no rent shall thereafter become payable by an occupant thereof until such unsanitary condition has been remedied to the satisfaction of the Board." Such legislation is, of course, only likely to be effective and equitable if it is carried out with due regard to the fact that tenants are themselves sometimes responsible for creating unsanitary conditions during the course of their tenancy. No one can have any sympathy with owners of unsanitary property who are denied the opportunity of collecting rent on such property, but to make a law of this kind enforceable, it is essential at the same time, to protect owners from the vandalism of bad tenants.

**Union of Municipalities**

The annual meeting of the Nova Scotia Union of Municipalities was held in Truro on August 29-31, and was attended by representatives of about 70 per cent of the municipalities in the province. Following an address which I delivered on *The Planning and Development of Land*, a resolution was passed recommending the Provincial Government to prepare the way for the purpose of securing the proper and economic development of its resources, by making, forthwith, a comprehensive survey and classification of the lands and other resources; and by considering methods to promote more intensive cultivation, closer settlement of fertile lands near existing means of communication, better planning of land and other things necessary for the above purposes.

**Highway Administration**

For a long time there has been considerable dissatisfaction in Nova Scotia regarding the system of statute labour in operation in connection with the maintenance of highways. The question of securing better roads

and improved highway administration has been brought prominently forward in recent years as a result of the development of motor traffic. The province has made a forward movement in a new act respecting public highways, which was passed in May last. The act provides for setting up a Provincial Highway Board, to consist of not less than three members. The duties of the board shall comprise the collection of information regarding the highways of the province, the laying out, planning and classifying of roads, and the controlling of the construction and maintenance of all roads in the province. A provincial highway fund is to be set up, to include sums voted by the Legislature, all fees collected under the Motor Vehicle Road Improvement Fund Act, all sums contributed by the Federal Government, and the proceeds of taxes levied under the act. The latter include a tax at the rate of  $\frac{1}{6}$  of one per cent on all property and income ratable for city or town purposes, and a poll tax to be levied and collected in every municipality. The change which is effected by this new act is indicated by the schedule under which no less than seventeen previous acts of Parliament were repealed. This improvement in the highway administration of Nova Scotia is likely to open up a new era in highway improvement in the Maritime Provinces, which are greatly in need of better means of communication by road.

#### NEW BRUNSWICK

##### St. John Scheme

Further progress is being made with the St. John town planning scheme referred to in previous reports.

In consultation with members of the Town Planning Board of the city, I have had the draft provisions of the scheme drawn up and these are now receiving consideration. During the year, I have paid further visits to the area and inspected the routes suitable for the main lines of communication. The delay in completing the details of this scheme is not due to any lack of activity on the part of the local Board, but to the facts that this is the pioneer scheme in Canada and therefore involves a great deal of labour, and that I am unable to give continuous attention to it for any length of time. In the death of the City Engineer of St. John, Mr. Murdock, which took place recently, the local Board has lost a valuable officer.

##### Better Roads Necessary

New Brunswick is making good progress with the classification of its lands. It is also taking active steps to organize a community settlement for returned soldiers. The improvement of its highway administration is an urgent need in this province; having regard to its wealth of

resources, there is probably no province which suffers more from lack of a good system of roads.

#### QUEBEC

##### New Model Town

A considerable part of my time has been given to the preparation of a plan for the new town about to be developed by the Riordon Pulp and Paper Company at Timiskaming in Northern Quebec. I have advised the Company regarding the selection of a site for the town and made a careful inspection of the proposed site and surroundings. In connection with the preparation of the plan, I have employed Messrs. Ewing, Lovelace & Tremblay, civil engineers of Montreal, to undertake a topographical survey, and Mr. Percival H. Mitchell, C.E., of Toronto, to prepare a report on heating and lighting. I have also made investigations regarding plans and materials for the erection of buildings.

##### Features of Plan

As a preliminary to the preparation of the plan, a contour map showing the levels of the site was first prepared and the streets were then laid out so as to secure easy grades, directness of route and absence of sudden deflections. If the usual method of rectangular survey had been adopted, the most important streets would have had a grade of from 10 to 18 per cent, but under the plan the grades have been reduced to from 3 to 5 per cent in most cases, with a maximum of 8 for short lengths.

Before any buildings have been erected, the line of each street has been blazed through the forest so as to fix the best street locations and to secure the best aspects for the dwellings. Areas are being set aside for open spaces, social centers, churches, and schools, in advance. The main approach to the town will be by a street 80 feet wide passing through a square on which the stores and public buildings will be erected.

It is proposed to make the town a model of its kind, as it is recognized by the promoters that healthy and agreeable housing and social conditions are of vital importance in securing efficiency of the workers, and that large employers of labour have a direct responsibility in providing proper shelter for their workers.

It is unfortunate that similar steps have not been taken in Canada, as in Britain and the United States, to provide good accommodation for workers in connection with munition and other industries, which have recently been developed under the stimulus of the government. According to Colonel Carnegie, Ordnance Adviser of the Imperial Munitions Board, the skill which has been acquired in Canada in connection with war work will be of great

value in peaceful commercial industries in time of peace for the expansion of Canada. Physical deterioration is, however, going on among those who are engaged in developing this skill for want of attention being given to the planning of community life and housing, thereby creating a great loss in a valuable by-product of the war. The example of this company might well be followed by other large corporations as a matter of enlightened self-interest as well as for the public good.

Bureau of  
Municipal  
Affairs

The Quebec Government propose to introduce a measure for the purpose of creating a Bureau of Municipal Affairs for the province. Should this measure be passed, the only provinces not having municipal departments or bureaus will be the three Maritime Provinces. It is hoped that the Quebec Government will also introduce a town planning bill during this session.

Pointe aux  
Trembles  
Housing Scheme

An interesting housing scheme is being carried out at Pointe aux Trembles, near Montreal, under the Quebec Housing Act. The act, which is similar to the one in operation in Ontario, enables local authorities to guarantee the bonds, with a restricted interest, of a private housing company. La Société des Logements Ouvriers was recently formed at Pointe aux Trembles for the purpose of operating under the act. A portion of the capital has been raised locally, and the remainder is being raised on bonds guaranteed by the local councils.

A substantial beginning has been made, and a considerable number of houses erected. The houses are being erected in comparatively open country, where land is not too high in value, although it is accessible to the street railway service that connects with Montreal.

The scheme embraces the development of a great part of the district, and a considerable area has been reserved for the erection of factories and warehouses. The latter will not be indiscriminately mixed up with the dwellings. The houses are built of durable material, and well finished in every detail. Concrete pavements and sidewalks are constructed, and the gardens are laid out and planted before houses are occupied. One cannot conceive of any person being attracted by opportunities to purchase lots and erect their own isolated dwellings, even with all the advantages of ownership, when they have the chance to rent a home from a society of this kind.

The scheme will afford a valuable object lesson to the rest of Quebec, and indeed to the whole of Canada. These are difficult

and expensive times in which to build, and if the society can operate successfully under present conditions, it will be bound to succeed when times are normal. We want more people in Canada, but we must first make available for them better places in which to live.

#### ONTARIO

**Two New Acts** In Ontario, a Planning and Development Act and an Act to create a Municipal Bureau for the province have been passed during the year.\* The passing of these acts was largely due to the efforts of the Commission. The legislation is not entirely satisfactory, but is in the right direction.

I regret that it has not been possible to complete the report on the housing conditions in Ottawa.

**Renfrew Plans** Further progress has recently been made in the preparation of the plans of the town of Renfrew, following a survey of the natural features of the land surrounding the town. Mr. Thomas Low, a citizen of Renfrew, has generously offered to donate \$5,000 for the purpose of laying out the Market Square, in the centre of the town, and Mr. A. V. Hall, landscape architect, of Toronto, has prepared the design.

**Plan for Hamilton** During the past few months considerable progress has also been made in connection with the preparation of a plan for the city of Hamilton. The first step consisted in the making of a map showing the existing physical conditions and buildings. This was followed by the preparation of a plan of the railway system of the city and surroundings. It was fortunate that certain new proposals, in connection with railway extensions within the city, caused the city authorities to realize the importance of obtaining a report from experts with regard to what should be the best system of railway development. As a consequence, Mr. W. F. Tye and Mr. N. Cauchon were appointed to make an investigation and report on the whole railway situation in the city. The result has been the preparation of a valuable report in which important recommendations are made to improve the system. The plan has been received with considerable favour by the citizens of Hamilton and will, no doubt, be carefully considered by the railway companies in connection with future extensions. It will now be possible for the city of Hamilton to proceed to the next stages of the preparation of its development scheme.

\*For the text of these acts, see Appendices III and IV.

The Third Annual Town Planning Conference for South-western Ontario was postponed from October last until the spring of 1918.

I have had to defer visits to Peterborough, London and other cities in Ontario, from which requests have been obtained for my services, until the early part of the year.

#### WESTERN PROVINCES

I have been unable to visit the Western Provinces since the last Annual Meeting, except on the occasion of the Civic Improvement Conference at Winnipeg in May last.

**Manitoba** No scheme has been started in Manitoba under the Town Planning Act of 1916, but steps are being taken to encourage several local authorities to put it into force at an early date. Considerable progress is being made in this province in connection with the formation of Civic Improvement Leagues.

**Saskatchewan** In Saskatchewan, the Provincial Government proposes to pass a Planning and Development Act at the next meeting of the legislature.\* A draft scheme has been prepared for Swift Current, but is not likely to be completed till legislation is obtained.

I have been asked to advise some of the local authorities in Alberta on the question of assessment and taxation. If these matters are to be dealt with in a satisfactory manner, town planning schemes will have to be prepared so as to enable the land to be classified and a proper basis made for assessment purposes.

**British Columbia** Progress in British Columbia has been suspended awaiting advice and help and the time is ripe for a visit to the province.

In all the provinces, there is increasing interest in the question of planning and developing land on scientific principles, and much progress is likely to be made during the coming year.

**'Rural Planning and Development'** A large part of the nine months that have elapsed since the last annual meeting has been taken up with the preparation of a report on *Rural Planning and Development*, which is in your hands, and with the beginning of a further report on *Urban Planning and Development*, now in course of preparation. These reports are needed to enable the public to appreciate the wide scope and technical difficulties of the subject

\*Since this report was presented a *Town Planning and Rural Development Act* has been placed on the statute books of Saskatchewan.

of planning and developing land in Canada. The subject of land settlement in all new countries is receiving special consideration at the present time, and the importance of increasing rural production and improving economic conditions in rural districts made it desirable to give first attention to rural development.

Miscellaneous  
Articles

A number of reports on small development schemes have been made, and a great deal of correspondence has had to be dealt with during the past nine months.

At the request of the Attorney General for South Australia, a series of town plans and drawings was sent to Adelaide for exhibition.

The issue of *Conservation of Life* has been continued, and lectures have been delivered in a number of cities and towns. We have begun the preparation of a lecture series to be delivered by voluntary workers.

The Civic Improvement League of Canada continues to make headway and to add to its strength and membership. A successful conference of the League was held at Winnipeg in May last, a report of which has been printed.

Widening  
Scope of Work

At the last annual meeting I reported on the desirability of widening the scope of our work in connection with town planning and using a terminology which would more aptly describe the meaning we had in our minds. That suggestion was favourably received and the result of the changes made has been to give the public a better idea of the aims of the town planning branch of our work and a more adequate appreciation of the work itself; dealing as it does with all phases of land and building development in town and country, the importance of promoting more scientific methods of rural as well as of urban development appears to be engaging the attention of prominent groups of citizens in all belligerent countries. It is generally agreed that recovery after the war in each nation will be the more rapid in proportion as more efficient methods are applied to secure the increase of production.

We cannot emphasize too strongly that the first object of all who desire to increase production is to conserve life and develop skill. Conservation of life not only means the saving of lives to the nation that are now being lost or made less efficient by avoidable causes; it means the development of all life, by means of improved training, more wholesome environment and better opportunities. It means the increase of skill in labour, the better education of the young, and the reduction of wasteful speculation. Production and

wealth may be enormously increased without adding to our liabilities as a result of borrowing new capital; and without, of necessity, adding to the mere quantity of the population by means of immigration. We have to persuade people to see that those who desire a return of the kind of prosperity that is produced by forced growth of population in order that it may be exploited for speculative purposes are either unpatriotic or ignorant of the folly of their methods to promote national well-being. We have to give them intelligent guidance as to how to achieve the right results rather than as to the desirability of achieving them. The chief duty of the Commission of Conservation and its officers lies in giving this guidance, although our efforts are necessarily inadequate, because our means and equipment are far from being proportionate to the size of the task to be performed.

Visit to  
Britain

I regret my inability to present this report in person owing to absence in Britain making enquiries regarding the steps that are being taken in England and Scotland to deal with housing and town planning during the war. I shall report with regard to that visit in due course.

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## Recommendations and Reports of Committees

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### Committee on Fisheries, Game and Fur-bearing Animals

**D**R. C. C. JONES: The Committee on Fisheries, Game and Fur-bearing Animals went over the ground covered by previous resolutions, and found that, to a very large extent indeed, their recommendations made a year ago had been carried out. We have, however, two short resolutions which we desire to present to the Commission. The first is:

THAT, in view of the necessity for conserving every form of direct and indirect food supply, the research work in connection with the utilization of fish waste be continued to such extent as circumstances permit.

These are the researches undertaken a year ago and not yet completed. The committee believe that they should be completed as soon as possible.

The second resolution is:

THAT your committee recommend that, as soon as possible, a qualified expert be engaged to undertake investigations relative to the conservation of Canadian fisheries.

The resolutions were seconded by Dr. Howard Murray and adopted.

### Committee on Forests

At the request of Senator Edwards, Mr. Clyde Leavitt read the report of this Committee as follows:

1. Notwithstanding the many adverse conditions, notable progress has been made during the past year in the direction of better conservation of our forest resources. The developments in connection with protection against forest fires are particularly gratifying.

2. No change is reported as to the situation in Nova Scotia. The Forest Protection Act is working well, and the forest fire loss is small.

3. The forest survey and land classification of Crown lands in New Brunswick is producing information of the greatest present and prospective value and should, by all means, be continued. This work will lay the basis for an enlightened policy in the administration of Crown lands, not only with respect to timber but with respect to agricultural settlement as well.

It is noted with satisfaction that the Provincial Government is now considering the consolidation, under the Forestry Division, of the various lines of forestry and fire protection work, including the supervision of scaling and logging. Favourable action in this direction is most urgently recommended. This action is particularly important in New Brunswick, where there is every reason to believe that the forests are already being overcut, and where the interests of the future demand the elimination of all avoidable waste in the woods, as well as the perpetuation of the forest through wise restrictions upon methods of logging.

In the proposed revision of the Forest Fires Act, provision should be made for the extension to all forest areas in the Province of the permit system of regulating settlers' clearing fires.

4. The province of Quebec is to be congratulated upon the extension of the co-operative idea of forest fire protection to include 80 per cent of the licensed Crown timber lands of the Province, as well as a considerable area of unlicensed Crown timber lands and of Crown granted lands. The four forest protective associations now in existence are doing admirable work, so far as the somewhat limited funds at their disposal will permit. The total area thus protected is about 70,000 square miles.

The Provincial Government should be urged to take up vigorously the matter of reforesting the more accessible areas of Crown lands upon which the forest cover has been destroyed by fire and upon which a satisfactory natural reproduction of tree species does not exist and is not to be anticipated. Every reasonable encouragement should also be offered in connection with the reforestation of Crown-granted lands by private owners. To secure reforestation on any large scale, it will be necessary to substitute for the general property tax some arrangement by which at least the major portion of the taxation on forest plantations shall be deferred until the forest crop shall have had a sufficient time to reach merchantable size. It is understood that the Government of Quebec now has this matter under consideration.

5. A new era in forest fire protection has begun in Ontario, with the transfer of this work to the Provincial Forestry Branch, early in 1917. A creditable beginning has been made and continued improvement is to be anticipated, as the organization develops.

It is to be hoped that, after the conclusion of the war, the Province may adopt a policy of extensive reforestation upon denuded Crown lands.

6. The Canadian Pulp and Paper Association is to be congratulated upon the recent organization of a woodlands section, to

concern itself definitely with the production of the forest crop, just as the technical section concerns itself with the manufacture or utilization of the crop, after it is produced. This is a notable step in advance, since it involves definite recognition, through specific action, that the forest is a crop, which may be reproduced time after time upon the same soil; that the rate of production of this crop may be stimulated or retarded, depending upon whether the methods of cutting are favourable or unfavourable; that the determination of such methods may be facilitated through investigation, co-operation and free discussion; and, finally, that such action is made necessary by the depletion of the most accessible supplies of pulpwood over large areas in all the provinces of eastern Canada.

7. Strong representations should be made to the Dominion Government favouring the adoption of adequate administrative measures for the enforcement of the technical cutting regulations applicable to operations on licensed timber berths. Apparently, it was the intention of Parliament, in enacting Section 58 of the Dominion Lands Act, to place the enforcement of these technical regulations on licensed lands in Dominion forest reserves under the Dominion Forestry Branch. However, if so, effect has not been given to such intention.

8. The Dominion Government is to be congratulated upon the prospects of early action upon the abolition of the patronage evil. The application of this reform to the field service of the Forestry Branch is absolutely essential to the efficient protection and administration of Dominion Crown timber lands.

9. No new Dominion forest reserves have been established since 1913, although large areas of non-agricultural lands in the west have been found upon examination to be chiefly valuable for forest purposes. It is to be hoped that the temporary withdrawals now in effect as to such areas may be made permanent at an early date, by act of Parliament.

10. The Government of Alberta should be urged to revise the Prairie Fires Ordinance, and the permit system of regulating settlers' clearing fires should be adopted. The Alberta Railways Act should also be amended to give the Public Utilities Commission full authority to prescribe any necessary requirements for protection against railway fires along provincially chartered lines.

11. Great credit is due the Governments of Saskatchewan and Manitoba for the improved forest fire legislation enacted last winter. The adoption of the permit system of regulating settlers' clearing fires is particularly to be commended.

12. The efficient handling of forestry and fire protection work in British Columbia has been given a strong impetus through the adoption of the merit system of appointment in the field service of the Provincial Forest Branch. Other forest provinces might follow this example with excellent results.

13. The Committee notes with great satisfaction the prospects for the establishment of a forest school by the University of British Columbia.

14. Renewed effort should be made to bring the Dominion Government railways under the jurisdiction of the Board of Railway Commissioners in respect to the prevention and control of fires occurring along the right of way. In case of probable delay in the consolidation and revision of the Dominion Railway Act, a special amendment to the Government Railways Act should be urged, having reference to the Dominion Railway Act as it now stands.

15. The white pine blister disease has become firmly established in southern Ontario and is threatening the white pine, especially the young growth, in the Trent watershed and the Georgian Bay district. It has also been found in several counties in Quebec. Competent authorities consider that it is not feasible, from a practical viewpoint, to eradicate the disease from the districts already heavily infected. It is, however, believed that much may be done to control or retard its spread to areas where it is not already found and to minimize its injurious effects where its occurrence is apparently threatening the white pine forests of a given district. To this end, the most vigorous action is imperative by the Dominion Government, as well as by the provincial governments concerned. The continuation and extension of the co-operation previously in effect between these agencies is indispensable for the future. It is felt that the Dominion Government should provide additional plant pathologists for this work, and also for conducting investigations of other diseases of trees, especially from an economic viewpoint.

16. The study of conditions on cut-over pulpwood lands, begun last summer under the direction of Dr. C. D. Howe, should by all means be continued and extended. Acknowledgment is made of valuable co-operation secured from the Laurentide Company, Limited, and from the Quebec Forest Service. The continuation and extension of this co-operation is assured for 1918, and further co-operation from other agencies is to be anticipated.

17. The investigation of the forest resources of Ontario has been delayed by the temporary loan of our Mr. R. D. Craig's services

to the Imperial Munitions Board, in connection with the stimulation of Sitka spruce production for airplane manufacture. It is recommended that, if a suitable man can be found whose services are not required on military work, he be secured to begin the collection of data respecting Ontario's forest resources and to act as Mr. Craig's assistant, after the return of the latter. A very considerable amount of exploration work will be necessary, in any event, and the whole project is of such magnitude as to fully justify, and in fact require, the assignment of at least two foresters to its prosecution, unless the completion of the work is to be delayed indefinitely, thus very seriously delaying similar work in other provinces not yet covered.

#### DISCUSSION

MR. W. B. SNOWBALL: The report on the forest resources of British Columbia has already proved its worth?

MR. LEAVITT: The use already made of our investigations in British Columbia by the Imperial Munitions Board in respect to airplane spruce has justified the expenditure many times over.

SENATOR W. C. EDWARDS: In moving the adoption of the resolutions which have just been read, I want to make one remark with regard to the limitation of the amounts in the hands of the various fire protection associations in the province of Quebec. The four associations spend whatever money they find necessary and they levy periodically on the lumbermen just what they require. They are not restricted. These associations have proved most effective, and I think it is regrettable that Ontario has not followed the example of Quebec in providing for the expense of its forest protection service. The expenditure will be far greater, and I do not think Ontario will obtain the same degree of efficiency. The lumbermen, above all others, are interested in the conservation of the forests; their investments are very large, and the work of protection is far safer in their hands than in those of any government. In saying that I do not in any way reflect on any government. It is well known that private enterprise always carries out work of that kind much more economically than a government can. I think that Ontario has made a serious mistake. The levy in Ontario is at least four times as heavy as in Quebec. I would strongly recommend New Brunswick in taking this matter up to follow the lead of Quebec rather than that of Ontario.

I have much pleasure in moving the adoption of the report.

MR. W. B. SNOWBALL: I beg to second the motion.

The motion was carried.

### Committee on Lands

Dr. F. D. Adams presented the following report from this Committee:

THAT, in carrying out the plan of the Committee as approved by the Commission, illustration county work has been conducted in Dundas county, Ontario, during the past summer along lines which have been mentioned in the address of the Chairman of the Commission;

THAT, the Committee has received the cordial co-operation of Dominion and Provincial officials wherever and whenever assistance could be rendered;

THAT, Mr. E. P. Bradt, District Representative of the Ontario Department of Agriculture, and Mr. J. W. Forrester, Inspector of Public Schools, have rendered especially valuable assistance in the inauguration and development of the illustration county work;

THAT, the Committee appreciates the value of the co-operation and assistance given and records its warm thanks to all who have taken part;

THAT, the Committee proposes to consider carefully the question of the development and extension of county illustration work and to direct the services of the Agriculturist particularly to the advancement and development of illustration county work in Dundas as may seem most expedient to accomplish the objects of the Committee.

THAT, in view of the urgent and increasing need for greater production of foodstuffs in Canada, the Committee desires to call attention again to the necessity of everyone who can putting forth the greatest possible effort to accomplish this end, and urges that farmers and all others who have actual production in their care should leave nothing undone which will bring about an increase in the supply of foodstuffs which are and will be needed by the Allies to the very greatest extent which Canada can furnish.

### DISCUSSION

DR. F. D. ADAMS: I beg to move, seconded by Dr. Bryce, that the report of the Committee on Lands be adopted. I may say that I have promised Mgr. Choquette that it should go in our records that he desires the establishment of an illustration county in the province of Quebec; and also that the Committee is going to look carefully into the question of surveying several counties in Quebec with a view to the selection of an illustration county.

## THE FOOD SITUATION

DR. J. W. ROBERTSON: A few statements should perhaps be made to emphasize the reason for that part of the Committee's report which urges that the greatest possible efforts be put forth to increase the production of foods. A world shortage of food has created a very grave situation for those who are responsible for the carrying on of the war by the allied nations. There is no likelihood of shortage of food in Canada, which, on the contrary, will have a large surplus for export. But there is very grave danger of serious embarrassment to the governments of the allied countries from shortage of food for the armies and lack of suitable foods at reasonable prices for the industrial populations in Great Britain, France and Italy.

*Causes of the  
World Shortage*

There are several contributing causes to the present real danger of an increasing scarcity of food in 1918.

The harvests of 1915 having been abundant, the food situation during the first two years of the war caused no serious anxiety. The very abundance of that harvest hid the danger. Then came a succession of changes, the cumulative effect of which has produced the present threatening condition. Partly from unfavourable weather, partly from the want of labour, partly from the inability to obtain fertilizers, the cereal crops of the western allies and neutrals, that is, wheat, rye, barley, oats and Indian corn, yielded about 16 per cent less in 1916 than in 1915. That meant about 2,000,000,000 bushels less of these grains harvested in 1916 than in 1915. In Canada the harvest of wheat, oats and barley in 1916 was only 61 per cent of that in 1915.

The great war, in its various undertakings by the armies, munition-making and transportation, has taken about 30,000,000 workers off the land; it has diverted their labour into other occupations. Instead of being producers of food they have become consumers of food on an unprecedented scale. Then there is the destruction of food by the hideous attacks of the submarines. Even before the submarines in their unrestricted and murderous campaign had done so much, men best in a position to know kept proclaiming the need for greater production and the need for the prevention of all waste of food.

*Prospects for  
Increases*

What are the prospects for easing the situation by increased production? Farmers are doing their best. Vacant lots in towns and cities have provided part of the summer food in thousands of homes; and vegetables from them have been stored. But, on the whole, the prospects for greatly increased production are not good. Competent farm labour is scarce and the ever-insistent weeds are becoming more prevalent.

It will take years in some countries to clean the fields and to bring up the yields of crops to the old rate per acre.

The situation in respect to animal products, such as beef, pork and milk, indicates a great scarcity. It is estimated that in the countries of the western allies there are now about 33,000,000 fewer cattle, swine and sheep than there were when the war broke out. It will take time to increase the herds and flocks. Meanwhile, everyone who can should 'go easy' in consuming beef and bacon; and should 'go strong' in planning to produce food for their homes as well as for export.

While there is no occasion for alarm, the usual reserves which carried the world over between harvests in the Northern hemisphere have been greatly reduced. There is every reason for intelligent, organized and sustained action to prevent disaster from overtaking us.

*Everyone a Food Controller* The personal effort of individuals is the only way whereby the supply of food can be increased.

Under modern conditions, one cannot expect the earth to receive a miraculous shower of manna; a Niagara of wheat to fill the empty granaries and elevators is not to be expected; food comes from single plants produced by nature in co-operation with the intelligent labour of individuals. All over Canada, farmers and gardeners have done their best and will continue to do their best to increase the quantity of food; and it is necessary for them and the rest of us to be just as diligent in conserving what has been produced, in preventing all waste, and in shifting our own consumption from flour, beef and bacon, which the armies and civilian populations need from us, to other wholesome foods which cannot be sent overseas.

*Conscripting to the Farm* MR. SNOWBALL: From what you have said, Dr. Robertson, no man should be conscripted from a farm to go into the army. No man should be conscripted who is a farmer or a farm-labourer; but he should be forced to go on the farm and stay on it. I am not opposed to conscription, but I am opposed to conscripting from a farm, if the food situation is as serious as you say.

DR. J. W. ROBERTSON: The Minister of Militia has said the same thing recently. I think something must be done to keep experienced farmers producing foodstuffs.

MR. W. B. SNOWBALL: The difficulty is to produce food products if men are conscripted off the farms.

DR. J. W. ROBERTSON: I admit the gravity of the situation. No matter what happens anywhere, there is no getting away from

the danger of a shortage of food on our side for three more harvests, even if we have peace next summer. The land and labour situation is so bad that there is no chance of catching up. A failure next year would mean actual starvation.

SENATOR W. C. EDWARDS: I pointed out two years ago that we would starve in 1918.

MR. W. B. SNOWBALL: I think we ought to pass a resolution asking that farmers' sons be left on the farms to produce. Conscription to the farm rather than to the army.

DR. GEORGE BRYCE: I agree with that. Let me cite the case of my own brother in Manitoba. Five men from a big farm with highly bred horses and cattle were conscripted, only two boys and the manager being left. The whole five should have been left. If the three who were conscripted are taken away on the first draft, all the cattle will have to be slaughtered. I do not know what position we, as a conservation commission can take, but I do say that the farming interests are in great danger unless close attention is paid to this matter.

DR. W. J. RUTHERFORD: The same thing is true in Saskatchewan, and, I believe, in all the western provinces. I know a case where exemption was refused a young man who, with another man helping him, produced over 4,000 bushels of wheat, 3,500 bushels of oats, 2,000 bushels of barley, 120 sheep, and 12 horses this year. A member of the tribunal, refusing him exemption, said: "We want men in the trenches; we do not want professional agriculturists." I could cite several other cases like that. I think the Commission could not render better service than to take such action as will bring the serious results of such a policy to the minds of the people. Once these young men are drafted, it is hard to get them back to the farm, even if they are given exemption at a later date.

MR. W. B. SNOWBALL: I would have them paid the \$1.10 a day and compelled to work on the farm.

#### Committee on Minerals

DR. F. D. ADAMS: I beg to submit the report of the Committee on Minerals.\* As it is lengthy, it is hardly necessary to read it. It deals chiefly with the question of the conservation of coal and the best methods of using this fuel, which has become so extremely valuable at the present time.

When in the West recently, I took up the matter of a meeting of the mine inspectors of all the western provinces; and the govern-

\*For this report, see page 183.

ments of Saskatchewan, Alberta and British Columbia have decided to send their chief mining inspectors to a conference to be held at the offices of the Commission here on Dec. 5th in order to consider, together with representatives of the Mines Branch and the Department of the Interior, the formulation of regulations to ensure a more economical extraction of coal from the western coal mines. The waste that is going on now in British Columbia and Alberta is very great. This is recognized by every mine manager, and by every mine inspector; and the present is the time at which we can, with the greatest advantage, press home on the Government and on the people the necessity of making some change in the present wasteful methods. During the past year, our Mining Engineer has been working in close co-operation with the Advisory Council for Scientific and Industrial Research in connection with the use of lignites in Saskatchewan. The researches which are now approaching completion are such as will enable the Government to convert inferior lignite of eastern Saskatchewan into a first-class domestic fuel as good as anthracite.

On the motion of Dr. F. D. Adams, seconded by Dr. Howard Murray, the report was adopted.

#### Committee on Public Health

On motion of Dr. Howard Murray, seconded by Dr. C. C. Jones, the report on town planning and land development\* as presented by Mr. Thomas Adams was adopted.

#### Committee on Press and Co-operating Organizations

DR. HOWARD MURRAY: In the unavoidable and regrettable absence of Mr. J. F. MacKay, Chairman of the Committee on Press and Co-operating Organizations, it falls to my lot to present the report and recommendations of that Committee. They are as follows:

The Committee on Press and Co-operating Organizations would suggest that very careful consideration be given to the question of using moving picture films for the purpose of securing publicity for conservation subjects, that estimates of cost of machines and supplies be procured, that the question of utilization of these films by picture theatres be looked into, and, if deemed feasible, and within the means of the Commission, that these means of publicity be utilized.

The Committee would also suggest for consideration that in the publication of the Annual Report of the Commission, greater numbers

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\*For this report, see page 194.

of the individual papers be printed and fewer copies of the complete cloth-bound edition, in order that those interested in the individual subjects may be supplied with the papers pertaining thereto, without necessitating the supplying of the complete volume. In this manner, greater circulation of the report could be secured without increasing the cost.

The Committee thought that moving-picture films would add to the interest of the information supplied by the Commission, and that they might be made to serve a very useful purpose.

The cost of production of books has nearly doubled since the war began, and some saving might be made by utilizing offprints of the papers in the Annual Report in place of the complete volume.

DR. BRYCE: As a member of the Committee, I have great pleasure in seconding this report. I think that these two suggestions are valuable.

The report was adopted.

#### Committee on Waters and Water Powers

Mr. C. A. McCool, Acting Chairman of the Committee on Waters and Water-powers, presented the Report of that Committee as follows:

Your Committee places itself on record as being opposed to the granting of permits to private interests to develop water-power on the St. Lawrence river. In its opinion, these powers should be developed by an international commission, which would utilize the maximum amount of power in the most economic manner possible and make it available to the neighbouring and tributary population of Canada and the United States upon fair and equitable terms.

Your Committee is also of the opinion that, in so far as possible, there should be uniformity of water-power regulations throughout the Dominion. The desirability of this is especially obvious where water-powers are located on interprovincial streams or on or near interprovincial boundaries. It is desirable, also, that a uniform definition of what constitutes inland navigable waters should be agreed upon by Dominion and Provincial authorities.

Your Committee is gratified at the progress the officials of the Commission have made in compiling an inventory of the water-power resources of Canada. The report on *The Water-powers of British Columbia* is in the printers' hands and will be issued shortly, whilst the gathering of information for a report on electrical power plants and systems of distribution in Canada is well under way.

The adoption of the Report of the Committee was moved by Mr. C. A. McCool and seconded by Dr. F. D. Adams, and carried.

On motion of Mr. W. B. Snowball the Commission adjourned.

## Appendices

### APPENDIX I

#### The Migratory Birds Convention Act (7-8 George V, chap. 18; assented to Aug. 29, 1917)

WHEREAS on the sixteenth day of August, one thousand nine hundred and sixteen, a Convention was signed at Washington respecting the protection of certain migratory birds in Canada and the United States, and ratifications were exchanged at Washington on the seventh day of December, one thousand nine hundred and sixteen; and whereas it is expedient that the said Convention should receive the sanction of the Parliament of Canada and that legislation be passed for insuring the execution of the said Convention: Therefore His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

1. This Act may be cited as *The Migratory Birds Convention Act.*
2. The said Convention of the sixteenth day of August, one thousand nine hundred and sixteen, which is set forth in the Schedule to this Act, is hereby sanctioned, ratified and confirmed.
3. In this Act and in any regulation made thereunder, unless the context otherwise requires—
  - (a) “close season” means the period during which any species of migratory game, migratory insectivorous, or migratory nongame bird is protected by this Act or any regulation made under this Act;
  - (b) “migratory game birds” means—  
Anatidæ or waterfowl, including brant, wild ducks, geese and swans;  
Gruidæ or cranes, including little brown, sandhill and whooping cranes;  
Rallidæ or rails, including coots, gallinules and sora and other rails;  
Limicolæ or shorebirds, including avocets, curlew, dowitchers, godwits, knots, oyster catchers, phalaropes, plovers, sandpipers, snipe, stilts, surf birds, turnstones, willet, woodcock, and yellowlegs;  
Columbidæ or pigeons, including doves and wild pigeons;
  - (c) “migratory insectivorous birds” means—  
Bobolinks, catbirds, chickadees, cuckoos, flickers, flycatchers, grosbeaks, humming birds, kinglets, martins, meadowlarks, nighthawks or bull bats, nuthatches, orioles, robins, shrikes, swallows, swifts, tanagers, titmice, thrushes, vireos, warblers, waxwings, whip-poorwills, woodpeckers, and wrens, and all other perching birds which feed entirely or chiefly on insects;

- (d) "migratory nongame birds" means—  
Auks, auklets, bitterns, fulmars, gannets, grebes, guillemots, gulls, herons, jaegers, loons, murres, petrels, puffins, shearwaters, and terns;
- (e) "Minister" means the Minister of the Interior;
- (f) "regulation" means any regulation made under the provisions of section four of this Act.

4. (1) The Governor in Council may make such regulations as are deemed expedient to protect the migratory game, migratory insectivorous and migratory nongame birds which inhabit Canada during the whole or any part of the year.

(2) Subject to the provisions of the said Convention, such regulations may provide,—

- (a) the periods in each year or the number of years during which any such migratory game, migratory insectivorous or migratory nongame birds shall not be killed, captured, injured, taken, molested or sold, or their nests or eggs injured, destroyed, taken or molested;
- (b) for the granting of permits to kill or take migratory game, migratory insectivorous and migratory nongame birds, or their nests or eggs;
- (c) for the prohibition of the shipment or export of migratory game, migratory insectivorous or migratory nongame birds or their eggs from any province during the close season in such province, and the conditions upon which international traffic in such birds shall be carried on;
- (d) for the prohibition of the killing, capturing, taking, injuring or molesting of migratory game, migratory insectivorous or migratory nongame birds, or the taking injuring, destruction or molestation of their nests or eggs, within any prescribed area;
- (e) for any other purpose which may be deemed expedient for carrying out the intentions of this Act and the said Convention, whether such other regulations are of the kind enumerated in this section or not.

(3) A regulation shall take effect from the date of the publication thereof in the *Canada Gazette*, or from the date specified for such purpose in any regulation, and such regulation shall have the same force and effect as if enacted herein, and shall be printed in the prefix, in the next succeeding issue of the Dominion Statutes, and shall also be laid before both Houses of Parliament within fifteen days after the publication thereof if Parliament is then sitting, and if Parliament is not then sitting, within fifteen days after the opening of the next session thereof.

5. (1) The Minister may appoint game officers for carrying out this Act and the regulations, and may authorize such game officers to exercise the powers of Justice of the Peace or the powers of a Police Constable. Such persons shall hold office during pleasure, and shall have, for the purpose of this Act and the said Convention,

such other powers and duties as may be defined by this Act and the regulations.

(2) Every game officer who is authorized by the Minister to exercise the powers of a Justice of the Peace or of a Police Constable shall, for all the purposes of this Act and the regulations, be *ex officio* a Justice of the Peace or a Police Constable, as the case may be, within the district within which he is authorized to act.

(3) Every such game officer shall take and subscribe an oath in the form following, that is to say:

"I, A.B., a \_\_\_\_\_ of

do solemnly swear that to the best of my judgment I will faithfully, honestly and impartially fulfil, execute and perform the office and duties of such

according to the true intent and meaning of *The Migratory Birds Convention Act* and the regulations made thereunder.

So help me God."

6. No one without lawful excuse, the proof whereof shall lie on him, shall buy, sell or have in his possession, any bird, nest or egg or portion thereof, during the time when the capturing, killing or taking of such bird, nest or egg is prohibited by law.

7. All guns, ammunition, boats, skiffs, canoes, punts and vessels of every description, teams, wagons and other outfits, decoys and appliances of every kind, used in violation of or for the purpose of violating this Act or any regulation, and any bird, nest or egg taken, caught, killed or had in possession, in violation of this Act or any regulation, may be seized and confiscated upon view by any game officer appointed under this Act, or taken and removed by any person for delivery to any game officer or justice of the peace.

8. Any game officer appointed under this Act who violates this Act or any regulation, or who aids, abets or connives at any violation of this Act or of any regulation, shall be liable, upon summary conviction before any recorder, commissioner of police, judge of the sessions of the peace, police stipendiary or district magistrate or any two justices of the peace, to a penalty not exceeding five hundred dollars and costs or six months' imprisonment and not less than one hundred dollars and costs or three months' imprisonment.

9. Any person who assaults, obstructs or interferes with any game officer or peace officer in the discharge of any duty under the provisions of this Act, or of any regulation, shall be guilty of a violation of this Act.

**10.** Any person who wilfully refuses to furnish information or wilfully furnishes false information to a game officer or peace officer respecting a violation of this Act or of any regulation, the existence of or the place of concealment of any bird, nest or egg, or any portion thereof captured, killed or taken in violation of this Act or of any regulation, shall be guilty of a violation of this Act.

11. Any game officer or peace officer may enter any place or premises in which he has reason to believe there exists migratory game, or migratory insectivorous, or migratory nongame birds, nests or eggs, or any parts thereof, in respect of which a breach of this

Act or of the regulations may have been committed, and may open and examine any trunk, box, bag, parcel or receptacle which he has reason to suspect and does suspect contains any such bird, nest or egg, or any part thereof.

**12.** Every person who violates any provision of this Act or any regulation shall, for each offence, be liable upon summary conviction to a fine of not more than one hundred dollars and not less than ten dollars, or to imprisonment for a term not exceeding six months, or to both fine and imprisonment.

### SCHEDULE CONVENTION

Whereas many species of birds in the course of their annual migrations traverse certain parts of the Dominion of Canada and the United States; and

Whereas many of these species are of great value as a source of food or in destroying insects which are injurious to forests and forage plants on the public domain, as well as to agricultural crops, in both Canada and the United States, but are nevertheless in danger of extermination through lack of adequate protection during the nesting season or while on their way to and from their breeding grounds;

His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British dominions beyond the seas, Emperor of India, and the United States of America, being desirous of saving from indiscriminate slaughter and of insuring the preservation of such migratory birds as are either useful to man or are harmless, have resolved to adopt some uniform system of protection which shall effectively accomplish such objects, and to the end of concluding a convention for this purpose have appointed as their respective plenipotentiaries:

His Britannic Majesty, the Right Honourable Sir Cecil Arthur Spring-Rice, G.C.V.O., K.C.M.G., etc., His Majesty's ambassador extraordinary and plenipotentiary at Washington; and

The President of the United States of America, Robert Lansing, Secretary of State of the United States;

Who, after having communicated to each other their respective full powers which were found to be in due and proper form, have agreed to and adopted the following articles:

**ARTICLE I**—The High Contracting Powers declare that the migratory birds included in the terms of this Convention shall be as follows:

**1. Migratory Game Birds—**

(a) Anatidæ or waterfowl, including brant, wild ducks, geese, and swans.

(b) Gruidæ or cranes, including little brown, sandhill, and whooping cranes.

(c) Rallidæ or rails, including coots, gallinules and sora and other rails.

(d) Limicolæ or shorebirds, including avocets, curlew, dowitchers, godwits, knots, oyster catchers, phalaropes, plovers, sandpipers, snipe, stilts, surf birds, turnstones, willet, woodcock, and yellowlegs.

(e) Columbidæ or pigeons, including doves and wild pigeons.

2. **Migratory Insectivorous Birds—**

Bobolinks, catbirds, chickadees, cuckoos, flickers, flycatchers, grosbeaks, humming birds, kinglets, martins, meadowlarks, night-hawks or bull bats, nut-hatches, orioles, robins, shrikes, swallows, swifts, tanagers, titmice, thrushes, vireos, warblers, waxwings, whippoorwills, woodpeckers, and wrens, and all other perching birds which feed entirely or chiefly on insects.

3. **Other Migratory Nongame Birds—**

Auks, auklets, bitterns, fulmars, gannets, grebes, guillemots, gulls, herons, jaegers, loons, murres, petrels, puffins, shearwaters, and terns.

ARTICLE II—The High Contracting Powers agree that, as an effective means of preserving migratory birds, there shall be established the following close seasons during which no hunting shall be done except for scientific or propagating purposes under permits issued by proper authorities.

1. The close season on migratory game birds shall be between 10th March and 1st September, except that the close of the season on the limicolæ or shorebirds in the Maritime Provinces of Canada and in those States of the United States bordering on the Atlantic ocean which are situated wholly or in part north of Chesapeake bay shall be between 1st February and 15th August, and that Indians may take at any time scoters for food but not for sale. The season for hunting shall be further restricted to such period not exceeding three and one-half months as the High Contracting Powers may severally deem appropriate and define by law or regulation.

2. The close season on migratory insectivorous birds shall continue throughout the year.

3. The close season on other migratory nongame birds shall continue throughout the year, except that Eskimos and Indians may take at any season auks, auklets, guillemots, murres and puffins, and their eggs for food and their skins for clothing, but the birds and eggs so taken shall not be sold or offered for sale.

ARTICLE III—The High Contracting Powers agree that during the period of ten years next following the going into effect of this Convention, there shall be a continuous close season on the following migratory game birds, to-wit:

Band-tailed pigeons, little brown, sandhill and whooping cranes, swans, curlew and all shorebirds (except the black-breasted and golden plover, Wilson or jack snipe, woodcock, and the greater and lesser yellowlegs); provided that during such ten years the close seasons on cranes, swans and curlew in the province of British Columbia shall be made by the proper authorities of that province within the general dates and limitations elsewhere prescribed in this Convention for the respective groups to which these birds belong.

ARTICLE IV—The High Contracting Powers agree that special protection shall be given the wood duck and the eider duck either

(1) by a close season extending over a period of at least five years, or (2) by the establishment of refuges, or (3) by such other regulations as may be deemed appropriate.

ARTICLE V—The taking of nests or eggs of migratory game or insectivorous or nongame birds shall be prohibited, except for scientific or propagating purposes under such laws or regulations as the High Contracting Powers may severally deem appropriate.

ARTICLE VI—The High Contracting Powers agree that the shipment or export of migratory birds or their eggs from any State or Province, during the continuance of the close season in such State or Province, shall be prohibited except for scientific or propagating purposes, and the international traffic in any birds or eggs at such time captured, killed, taken, or shipped at any time contrary to the laws of the State or Province in which the same were captured, killed, taken, or shipped shall be likewise prohibited. Every package containing migratory birds or any parts thereof or any eggs of migratory birds transported, or offered for transportation from the Dominion of Canada into the United States or from the United States into the Dominion of Canada, shall have the name and address of the shipper and an accurate statement of the contents clearly marked on the outside of such package.

ARTICLE VII—Permits to kill any of the above-named birds which, under extraordinary conditions, may become seriously injurious to the agricultural or other interests in any particular community, may be issued by the proper authorities of the High Contracting Powers under suitable regulations prescribed therefor by them respectively, but such permits shall lapse or may be cancelled, at any time when, in the opinion of said authorities, the particular exigency has passed, and no birds killed under this article shall be shipped, sold, or offered for sale.

ARTICLE VIII—The High Contracting Powers agree themselves to take, or propose to their respective appropriate law-making bodies, the necessary measures for insuring the execution of the present Convention.

ARTICLE IX—The present Convention shall be ratified by His Britannic Majesty and by the President of the United States of America, by and with the advice and consent of the Senate thereof. The ratifications shall be exchanged at Washington as soon as possible and the Convention shall take effect on the date of the exchange of the ratifications. It shall remain in force for fifteen years, and in the event of neither of the High Contracting Powers having given notification, twelve months before the expiration of said period of fifteen years, of its intention of terminating its operation, the Convention shall continue to remain in force for one year and so on from year to year.

In faith whereof, the respective Plenipotentiaries have signed the present Convention in duplicate and have hereunto affixed their seals.

Done at Washington this sixteenth day of August, 1916.

(L.S.) CECIL SPRING-RICE.  
(L.S.) ROBERT LANSING.

## APPENDIX II

### The Northwest Game Act

(7-8 George V, chap. 36; assented to Sept. 20, 1917)

HIS MAJESTY by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

1. This Act may be cited as *The Northwest Game Act*.

2. In this Act and in the regulations, unless the context otherwise requires,—

- (a) "Minister" means the Minister of the Interior;
- (b) "Game Officer" means a game officer appointed as such under or by the provisions of this Act or the regulations;
- (c) "Game Warden" means a game warden appointed as such under the provisions of this Act or the regulations;
- (d) "Game" means and includes all wild mammals and wild birds protected by this Act or by any regulation, and the heads, skins, and every part of such mammals and birds;
- (e) "Close season" with respect to any kind of game means the period during which the hunting, killing, destroying, injuring, trapping, taking, capturing, selling, trading in or molesting of such kind of game is prohibited or restricted by this Act or by any regulation;
- (f) "Open season" with respect to any kind of game means the period during which such kind of game may be hunted, killed, destroyed, trapped, taken, captured, sold, traded in or possessed;
- (g) "Regulation" means any regulation made by the Governor General in Council under the authority of this Act;
- (h) "Northwest territories" means the Northwest territories formerly known as Rupert's land and the Northwestern territory (except such portions thereof as are included in the provinces of Ontario, Quebec, Manitoba, Saskatchewan and Alberta, and Yukon) together with all British territories and possessions in North America and all islands adjacent thereto not included within any province except the colony of Newfoundland and its dependencies.

3. This Act shall apply to the Northwest territories.

4. (1) Except as hereinafter provided, the following shall not be hunted, trapped, taken, killed, shot at, wounded, injured or molested in any way during the following times of year respectively:

- (a) Moose, deer and mountain goat, between the first day of April and the first day of September;
- (b) Caribou and mountain sheep, between the first day of April and the first day of August, and between the first day of October and the first day of December;

- (c) Mink, fisher and marten, between the fifteenth day of March and the first day of November;
- (d) Otter and beaver, between the fifteenth day of May and the first day of October;
- (e) Muskrat, between the fifteenth day of May and the first day of October;
- (f) White fox, between the first day of April and the fifteenth day of November;
- (g) Partridge, prairie chicken, ptarmigan and other species of grouse, between the first day of January and the first day of September;
- (h) Wild geese and wild duck, with the exception of eider duck, between the fifteenth day of December and the first day of September.

(2) Except as hereinafter provided, no eggs in the nest of any of the said birds or in the nest of any other species of wild fowl, shall be taken, destroyed, injured or molested at any time of the year.

(3) Notwithstanding anything contained in subsections one and two, the game therein mentioned may be lawfully hunted, taken or killed, and the eggs of birds therein mentioned may be lawfully taken, by Indians or Eskimos who are *bona fide* inhabitants of the Northwest territories, or by other *bona fide* inhabitants of the said territories, and by explorers or surveyors who are engaged in any exploration, survey or other examination of the country, but only when such persons are actually in need of such game or eggs to prevent starvation.

(4) Except as hereinafter provided, buffalo or bison shall not be hunted, trapped, taken, killed, shot at, wounded, injured or molested at any time of the year.

(5) Except as hereinafter provided, musk-ox and wapiti or elk shall not be hunted, trapped, taken, killed, shot at, wounded, injured or molested at any time of the year, except in such zones and during such period as the Governor in Council may prescribe.

(6) Except as hereinafter provided, white pelicans shall not be hunted, trapped, taken, killed, shot at, wounded, injured or molested at any time of the year.

(7) Except as hereinafter provided, the following shall not be hunted, trapped, taken, killed, shot at, wounded, injured or molested in any way:

(a) Wild swan, until the first day of January, one thousand nine hundred and twenty-eight.

(b) Eider duck, until the first day of January, one thousand nine hundred and twenty-three.

(8) Notwithstanding the provisions of subsections one, two, four, five and six, the Minister or any officer or person authorized by him, may issue a permit to any person to take or kill at any time such mammals and birds, or take the eggs or nests of birds, for scientific or propagation purposes.

(9) Excepting a native-born Indian, Eskimo or halfbreed, who is a *bona fide* resident of the Northwest territories, no person shall engage in hunting, trapping, or trading or trafficking in game, without first securing a license so to do.

- (a) The fees for such licenses when issued to a *bona fide* resident of the Northwest territories shall be:—  
For hunting and trapping, two dollars.  
For trading or trafficking, five dollars.
- (b) The fees for such licenses, when issued to non-residents of the Northwest territories, shall be fixed by the Governor in Council.

(10) The Governor in Council may make regulations—

- (a) Regulating or prohibiting the use or possession of poison, ammunition, explosives, traps, snares, spring-guns, firearms and other implements, appliances and contrivances for hunting, killing, taking, trapping, destroying or capturing game: Provided that such prohibition shall not apply to such types of guns, rifles, traps and ammunition as are now in common use;
- (b) permitting the hunting, killing, taking, capturing or trapping of specimens of game for scientific or propagation purposes;
- (c) governing the issue of licenses and permits, and prescribing the terms and conditions thereof;
- (d) authorizing the appointment by the Minister of game officers and game wardens, and prescribing their duties;
- (e) regulating the possession of and transportation of game;
- (f) governing the number of mammals and birds that may be killed or taken by any person in one season;
- (g) for any other purpose which may be deemed expedient for carrying out the provisions and intentions of this Act, whether such regulations are of the kind enumerated or not.

(11) Any regulation made under the provisions of this section may be made to apply to the whole or any part of the Northwest territories.

5. No one shall enter into any contract or agreement with or employ any Indian, Eskimo, or other person, whether such Indian, Eskimo, or other person is an inhabitant of the country to which this Act applies or not, to hunt, trap, kill, or take game contrary to the provisions of this Act or a regulation; or to take, contrary to the provisions of this Act or a regulation, any egg, nest or part thereof.

6. All members of the Royal Northwest Mounted Police, and the sub-collector of Customs at Herschel island, shall be ex-officio game officers.

7. (1) Any game officer, when he considers it necessary so to do, may appoint a constable or constables to apprehend any person who has done, or who he has reason to believe has done, anything in contravention of any of the provisions of this Act or the regulations.

(2) Such constable shall, upon apprehending such person, arrest him and bring him for trial before the nearest justice of the peace, together with any game, eggs or nests, or parts thereof, protected by this Act or a regulation, found in the possession of such person at the time of his apprehension.

8. No person without lawful excuse, the proof whereof shall lie on him, shall buy, sell or have in his possession any game, or the nests, or eggs of any wild bird, or any part thereof, during the close season.

9. (1) All guns, ammunition, traps, boats, skiffs, canoes, punts and vessels of every description, horses, dogs, wagons, sleighs, and other outfits, decoys, and appliances, and materials of every kind, used in violation of or for the purpose of violating this Act or any regulation, may be seized upon view by any game officer or game warden, or taken and removed by any person appointed for such purpose by a game officer or game warden, for delivery to a justice of the peace, who may order such chattels to be held pending the payment of any penalty for any offence committed.

(2) (a) Any game taken, caught, killed or had in possession, or any nest or egg or parts thereof taken or had in possession, in violation of this Act or any regulation; and,

(b) any poison, ammunition, explosives, traps, snares, spring-guns, fire-arms, and other implements, appliances and contrivances, the use of which is prohibited under the provisions of this Act;

may be seized on view by any peace officer, game officer or game warden, and shall be forfeited to the Crown.

10. Any game officer, game warden or peace officer who violates this Act or any regulation, or who aids, abets or connives at any violation of this Act or of any regulation, shall be liable upon summary conviction to a penalty not exceeding five hundred dollars and not less than one hundred dollars, or to imprisonment for any term not exceeding six months, or to both fine and imprisonment.

11. Any person who assaults, obstructs or interferes with any game officer, game warden, constable or other peace officer, in the discharge of any duty under the provisions of this Act or of any regulation, shall be guilty of a violation of this Act.

12. Any person who wilfully furnishes false information to a game officer, game warden or peace officer respecting a violation of this Act or of any regulation, the existence of or the place of concealment of any game, nest or egg, or portion thereof, captured, killed or taken in violation of this Act or of any regulation, shall be guilty of a violation of this Act.

13. Any game officer, game warden, constable or other peace officer may enter any place, building or premises, or any ship, vessel, or boat in which he has reason to believe there exists game, nests or eggs or any parts thereof in respect to which a breach of this Act or of the regulations has been committed, and may open and examine any trunk, box, bag, parcel or other receptacle which he has reason to suspect and does suspect contains any such game, nest or egg or any part thereof.

14. Any person found committing an offence against this Act may be arrested on view by any game officer, game warden or peace officer.

15. Every justice of the peace may upon his own view convict for any offence against this Act or a regulation.

16. The killing, taking, trapping or capturing of each mammal or bird, contrary to the provisions of this Act or a regulation, shall constitute a separate offence.

17. Every game officer and every game warden shall before acting take and subscribe to the following oath:—

A. B. , game officer (or game warden), appointed under the provisions of *The Northwest Game Act* and the regulations do swear that to the best of my judgment I will faithfully, honestly and impartially execute and perform the office and duty of such game officer (or game warden) according to the true intent and meaning of *The Northwest Game Act* and the regulations, So help me God.

18. Any person who violates any of the provisions of this Act for which no other penalty is provided, or of any regulation, shall be guilty of an offence and shall be liable on summary conviction to,—

- (a) a fine not exceeding five hundred dollars or less than one hundred dollars, or to imprisonment for any term not exceeding six months, or to both fine and imprisonment, for any offence against subsections four and five of section four;
- (b) a fine not exceeding two hundred dollars or less than fifty dollars, or to imprisonment for any term not exceeding three months, or to both fine and imprisonment, for any offence under subsection nine of section four, or under section eleven;
- (c) a fine not exceeding one hundred dollars or less than five dollars, or to imprisonment for any term not exceeding two months, or to both fine and imprisonment, for any other offence against this Act or a regulation.

19. When because of the distance, or for want of conveyance or communication, or for any other cause, it is not convenient to confine any convicted person in the nearest gaol, or other place of confinement, the convicting authority shall have power to confine such person in any suitable building which is more convenient to the place of trial, and to take all necessary precautions to prevent his escape therefrom.

20. (1) Whenever by this Act it is made an offence to do any act without holding a license therefor, the onus in any prosecution shall be upon the person charged, to prove that he was the holder of the license required by this Act.

(2) In any prosecution under this Act the onus of proof as to his *bona fide* residence in the Northwest territories shall be upon the defendant.

21. Chapter one hundred and fifty-one of the Revised Statutes of Canada, 1906, is hereby repealed.

### APPENDIX III

#### The Planning and Development Act, Ontario

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. This Act may be cited as *The Planning and Development Act.*

2. In this Act,

(a) "Urban Zone" shall mean

In the case of a city the area within five miles of said city, but exclusive of any part of another city;

In the case of a town the area within three miles of said town, but exclusive of any part of a city or other town;

In the case of a village the area within three miles of such village, exclusive of any part of a city or town or other village.

(b) Where part of a town or village is within the urban zone of a city, or part of a village is within the urban zone of a town, the whole of such town or village shall be deemed to be within the urban zone of such city or town, as the case may be;

(c) "Joint urban zone" shall mean an area included within the urban zones, as above defined, of two or more municipalities;

(d) "Senior municipality" shall mean as between a city, town or village, the municipality of the higher class, and as between two municipalities of the same class it shall mean the municipality having the larger population, according to the last revised assessment roll of each;

(e) "Board" shall mean "Ontario Railway and Municipal Board."

3. This Act shall apply to lands within cities, towns and villages and the urban zones as above defined surrounding the same.

4. (1) The council of a city, town or village may procure to be made for adoption by it a general plan of such city, town or village, and the urban zone adjoining it; or of such portion of the same as such council may deem expedient;

(2) Such plan shall show all existing highways and any widening extension or relocation of the same which may be deemed advisable, and also all proposed highways, parkways, boulevards, parks, play grounds and other public grounds or public improvements, and shall be certified by an Ontario land surveyor;

(3) Such plan may be amended from time to time by the council as it may deem expedient;

(4) Such general plan, or plan amending the same, shall be approved by the board before being finally adopted by the council

of such city, town or village, and upon the application to the board for such approval the council of all municipalities concerned shall, after notice to them, be entitled to be heard by counsel or agent;

(5) Upon such application the board shall have power to order such changes to be made in such plan as it may deem necessary or proper;

(6) A copy of such general plan, and of any plan amending the same, as approved by the board and adopted by the council, shall be filed with the clerk of the city, town or village, and with the clerk of any municipality within which is situate such urban zone or any part thereof, and also with the Board, and in the case of a joint urban zone a copy of said plan shall also be filed with the clerk of each of the urban municipalities which such joint urban zone adjoins, and such plans shall be open to inspection without fee by any person at all reasonable times;

5. (1) No plan of survey and subdivision of land within a city, town or village shall be registered unless it has been approved by the council of such city, town or village, or by the board;

(2) No plan of survey and subdivision of land within an urban zone or joint urban zone shall be registered unless it has been approved by the council of each municipality within which any part of such land is situate, and by the council of any city, town or village which such urban zone or joint urban zone adjoins, or by the board;

(3) No plan of survey and subdivision of land abutting on a highway of a less width than 66 feet, or upon which there is laid out a street of a less width than 66 feet, shall be registered unless it has been approved by the proper municipal council or councils and by the board;

(4) No lot laid down on a plan of survey and subdivision of land which has not been approved as in this section required, shall be sold or conveyed by a description referring to such plan or to the lot as laid down on such plan.

6. Where any person is desirous of surveying and subdividing into lots, with a view to the registration of a plan of survey and subdivision, a tract of land situate in any city, town or village, or in any urban zone, the following proceedings shall be had and taken:

- (1) Such person shall submit a plan of the proposed survey and subdivision prepared in accordance with the provisions of *The Registry Act* to the council of the city, town or village, and also, where the land is situate within an urban zone, to the council of each municipality within which any part of the land is situate;
- (2) The council of such city, town or village shall forthwith refer such plan to its engineer or other officer appointed for the purpose;
- (3) Such engineer or other officer shall, without delay, consider such plan, and report in writing to the council whether in his judgment such plan should be approved by the Council and what, if any, changes should be made therein.

7. In considering and reporting upon such plan, such engineer or other officer shall have regard to the following matters:

- (1) Where the land is situate in a city, town or village:
  - (a) The number and width of the highways;
  - (b) The size and form of the lots;
  - (c) Making the subdivision conform, as far as practicable, to any general plan adopted as aforesaid; or where no such general plan has been adopted, making it conform as far as practicable and desirable to the plan upon which the surrounding or adjacent lands have been laid out;
  - (d) What other lands, if any, are related to the land in such plan within the meaning of section 12;
- (2) Where the land is situate within an urban zone:
  - (a) The proximity of the land to any city, town or village adjoining such urban zone;
  - (b) The probability of the limits of such city, town or village being extended so as to include it;
  - (c) The number and width of the highways shown in said plan, and the providing of adequate driveways and thoroughfares connecting such city, town or village with the urban zone;
  - (d) Making the subdivision conform, as far as practicable, to such general plan adopted as aforesaid, or if no such general plan has been adopted, making it conform, as far as practicable and desirable, to the plan on which that part of the city, town or village nearest to the land is laid out;
  - (e) The size and form of the lots;
  - (f) What other lands, if any, are related to the land in such plan within the meaning of section 12.

8. (1) The council of the city, town or village, upon the receipt of the report of such engineer or other officer shall, without delay, consider the same, and may approve, or refuse to approve, the plan;

(2) In considering such plan with a view to its decision, the council shall have regard to the matters enumerated in section 7, and shall set out in writing the grounds of its decision, and file the same with the clerk of such council.

9. (1) Where the land is situate within an urban zone at least four weeks' notice of the intention of the council of the city, town or village to consider the report of such engineer or other officer, shall be given to the clerk of each municipality within which any part of the land is situate;

(2) Such notice shall be in writing, and may be mailed prepaid to the clerk of the municipality, and shall be accompanied by a copy of the report of the engineer or other officer;

(3) Any municipal corporation so notified shall be entitled to be heard by counsel or agent before the council, upon the consideration of such report.

**10.** In the case of a joint urban zone of two or more municipalities, the council of the senior municipality shall exercise, in respect of such joint urban zone and land situate therein, such powers as are exercisable by the council of a city, town or village in respect of the urban zone adjoining it and land situate therein; but upon the consideration of a plan of land situate in such joint urban zone by the council of the senior municipality, or by the board, the councils of the other municipalities shall be entitled to notice and to be heard.

**11.** (1) If, upon consideration of the report of the engineer or other officer, the council of a city, town or village fails to approve a plan of land situate within such city, town or village or, in the case of a plan of land situate within an urban zone, or joint urban zone, if the council of either, or any of the municipalities concerned, fails to approve such plan, the person submitting such plan may apply to the board for approval of the same;

(2) The board in determining such application shall have regard to the matters enumerated in section 7, and may approve or refuse to approve such plan, and shall have power to order such changes to be made in such plan as to the board may seem necessary or proper.

**12.** (1) Where the plan submitted is of land which is so related to other lands in the vicinity, whether owned by the same or different owners, that it is expedient that all such lands should be treated as one entire parcel for the purposes of subdivision under this Act, the owners of all such lands may be notified to attend before the council or board, as the case may be, at the hearing of any application for the approval of such plan; and any agreement in writing or plan for the subdivision of such lands made or adopted by the owners of such lands, or any part of them, and approved by the councils of the municipalities concerned, or by the board, as the case may be, shall be registered in the proper Land Titles Office or in the Registry Office for the registration division in which such lands, or any of them, are situate, and thereafter no plan of subdivision of such lands, or of any part of them, shall be registered unless it is in accordance with such agreement or plan;

(2) Such agreement or plan may be altered from time to time by the parties thereto, or their representatives or successors in title, with the approval of the councils concerned, or of the board, if the owners of all the lands embraced in the agreement or shown on the plan assent to such alteration;

(3) No such agreement or plan for the subdivision of lands shall be binding upon any prior mortgagee of such lands, or of any part of them, except with the consent of such mortgagee.

**13.** Approval of a plan by a municipal council or by the board shall be indicated by a certificate to that effect upon the plan, signed by the clerk or secretary respectively, and authenticated by the seal of the municipal corporation or board, as the case may be.

**14.** In the case of a tract of land within a city, town or village, or in an urban zone, which has not been subdivided according to a plan approved under this Act, no part of it which abuts upon a highway of a less width than 66 feet, or which is situate within a

distance of 33 feet from the centre line of such highway, shall be severed from said tract and sold under a description by metes and bounds or otherwise without the approval of the board, and no deed of conveyance or mortgage in fee of such part of said tract shall be registered without the approval of the board, provided that this section shall not apply to sales of land according to a plan of survey and subdivision registered in the proper Registry Office prior to the coming into force of this Act.

15. Where any plan or agreement prepared or made under this Act provides for the widening, extension, relocation or other alteration, in whole or in part, of a highway under the jurisdiction of a county council, or highway commission, such plan or agreement shall not be adopted or approved by the council of any city, town or village, or by the board, until such county council or highway commission, as the case may be, has had an opportunity of being heard by counsel or agent after due notice.

16. (1) The council of a city, town or village may appoint a commission to be known as "The Town Planning Commission of the city, town or village (*as the case may be*) of \_\_\_\_\_";

(2) Such commission shall be a body corporate and shall consist of the head of the municipality and six persons, being rate-payers, appointed by the council;

(3) The members of such commission, except the head of the municipality, shall hold office for three years, or until their successors have been appointed; provided that on the first appointment of the members of such commission the council shall designate two of such members who shall hold office for one year, two who shall hold office for two years, and two who shall hold office for three years;

(4) Any member of the commission shall be eligible for reappointment;

(5) The commission of any city, town or village, upon its appointment, shall have and exercise all the powers and discharge all the duties of this Act, vested in and exercisable by the council of such city, town or village;

(6) The commission shall elect a chairman who shall preside at all the meetings of the commission;

(7) Four of the members of the commission present at any meeting shall constitute a quorum;

(8) The clerk, engineer, and other officers of the city, town or village shall, at the request of the commission, do and perform all such duties under this Act, as they, or any of them, would do and perform for the council of such city, town or village in the like case, if such commission had not been appointed;

(9) The treasurer of such city, town or village shall pay all expenses incurred by the commission under this Act, upon presentation of accounts for the same certified by the chairman.

17. The rules of practice and procedure adopted by the board shall apply to applications under this Act, and all persons and municipal corporations concerned shall be entitled to be heard, and may be represented by counsel or agent at the hearing.

18. *The City and Suburbs Plans Act*, being chapter 194 of The Revised Statutes of Ontario, is hereby repealed.

## APPENDIX IV

### The Bureau of Municipal Affairs Act, Ontario

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. This Act may be cited as *The Bureau of Municipal Affairs Act.*
2. In this Act,
  - (a) "Bureau" shall mean The Bureau of Municipal Affairs established under the provisions of this Act.
  - (b) "Director" shall mean the Director of the Bureau.
3. There is hereby established a branch of the Public Service of Ontario to be known as "*The Bureau of Municipal Affairs.*"
4. The Bureau shall be attached to such one of the departments of the Public Service as may be designated by the Lieutenant-Governor in Council, and shall be under the direction and control of the Minister in charge of that department.
5. The Lieutenant-Governor in Council may appoint an officer to be known as the Director of the Bureau of Municipal affairs, and such engineers, inspectors, auditors, officers, clerks and servants as may be deemed advisable.
6. The Director for the purposes of *The Public Service Act* and *The Audit Act* shall rank as the deputy head of a department and in respect to matters assigned to the Bureau shall exercise and perform the powers and duties of the deputy head of a department.
7. The Director, acting under the direction of the Minister, shall preside over the Bureau and shall perform such other duties as may be assigned to him by the Lieutenant-Governor in Council or by the Minister.
8. Wherever by any Act of this Legislature an officer engaged in the administration of the law relating to any of the matters assigned to the Branch by this Act is directed to report to the Minister, the report shall, unless the Minister otherwise requires, be made to the Director, and every such officer shall act under and obey the directions of the Director.
9. (1) There shall be assigned to the Bureau the administration of *The Municipal and School Accounts Audit Act.*  
(2) The Provincial Municipal Auditor shall be an officer of the Bureau.  
(3) All returns required by any Act to be made to the Secretary of the Bureau of Industries by any municipal officer shall hereafter be made to the Director.

**10.** (1) The Bureau shall superintend the system of book-keeping and keeping accounts of the assets, liabilities, revenue and expenditure of all public utilities as defined by *The Public Utilities Act* which are operated by or under the control of a municipal corporation or a municipal commission, and may require from any such municipal corporation or commission such returns and statements as to the Bureau may seem proper, and may extract from such returns and statements such information as, in the opinion of the Bureau, may be useful for publication, and may embody such portions of such returns and statements in the annual report of the Bureau as to it may seem proper.

(2) A municipal corporation or commission which refuses or neglects to comply with the provisions of this section shall incur a penalty not exceeding one hundred dollars for every week it may be in default, recoverable under *The Ontario Summary Convictions Act*, and in addition the Bureau may authorize an auditor to secure such returns and statements at the expense of the municipal corporation or commission.

(3) This section shall not apply to a public utility for the development or distribution of electrical power or energy operated or controlled by a municipal corporation or commission.

**11.** It shall be the duty of the Bureau to

- (a) Issue from time to time and send to the clerk of every municipality bulletins dealing with the administration of each branch of municipal affairs in order to secure uniformity, efficiency and economy in such administration;
- (b) Collect such statistical and other information respecting the affairs of municipal corporations in Ontario as may be deemed necessary or expedient from time to time;
- (c) Enquire into, consider and report upon the operation of laws in force in other provinces of the Dominion and in Great Britain and in any foreign country having for their object the more efficient government and administration of the affairs of municipal corporations, and make such recommendations and suggestions thereon as may be deemed advisable;
- (d) Consider and report when requested by the Minister upon any petition for or suggestion of a change in the laws of Ontario relating to the powers and duties of municipal corporations;
- (e) Prepare and transmit to the Lieutenant-Governor in Council annually a report upon the work of the Bureau during the preceding year, together with such statistics and other information as may have been collected in the Bureau;
- (f) Perform such other duties as may from time to time be assigned to it by the Lieutenant-Governor in Council.

**12.** Nothing in this Act shall affect any of the powers conferred by any Act on the Hydro-Electric Power Commission of Ontario, The Ontario Railway and Municipal Board, The Provincial Board of Health, or any functionary, body or officer, and if any matter affecting any of such powers comes to the Bureau it shall be transferred to the proper functionary, body or officer to be dealt with.

**13.** Subsection 2 of section 40 of *The Public Utilities Act* is repealed and the following substituted therefor:

- (2) Subsection 1 shall be subject to section 10 of *The Bureau of Municipal Affairs Act*.
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## APPENDIX V

### Importance of a Permanent Policy in Stocking Inland Waters\*

BY

JOHN W. TITCOMB  
*Conservation Commission, State of New York*

THE longer and more varied one's experience in the conservation of the aquatic resources of this country, the more apparent and complex become the difficulties which present themselves when attempting to discuss the subject in a brief address before an association, national in scope. I shall, therefore, confine myself specifically to waters of the latitude with which I am more familiar, but, at the same time, outline a plan which may be applied to all states.

Just at this crisis in our history, the fishery resources of the country are receiving especial attention and many impractical recommendations have been made by well-intentioned persons who are not familiar with the subject, as well as by some who, from selfish motives, want to 'let down the bars' to conservation and to disregard the laws of nature which are the basis for regulations in regard to the methods and seasons for taking fish. A recent news item says, that "By direction of the Governor of Wisconsin, the Conservation Commission of that State will seine all rivers within their jurisdiction for rough fish to combat the rising prices of food stuffs." Another item says, that "Iowa will probably be the first State to amend the laws in order to permit the free use of rough fish in the Mississippi River." College professors have come forward with recommendations to relax the laws for the protection of fish during the present war. Incidentally, I may say that similar appeals are being made to those in authority with reference to the taking of all kinds of game.

In commenting on this let me say that proper *regulations for the protection of fish are as essential to the stocking of our waters as is fish culture and all efforts relevant thereto; that, if the fishery laws of the various states were fundamentally right before the war, they are just as essential to-day as they were then.*

Should Guard      In a crisis like the present one, it is quite proper  
Against              that we should scrutinize our fish laws with a view  
Depletion              to ascertaining whether they are sound, and, if not,  
steps should be taken, by legislation if necessary, which will permit  
the taking of fish to the fullest extent permissible without *depleting the annual supply*; but all the regulations with reference to the  
fisheries should be so administered that the annual crop of fish next  
year and in years to come will be greater than it is this year. Let  
us hope that we may never be obliged to draw upon our natural

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\*An address given before the American Fisheries Society at its Annual Convention in St. Paul, Minn., August 29, 1917.

resources to the extent of depletion, but let us properly conserve our resources now in order that we may be prepared to meet any emergencies which may arise in the future.

**Antagonistic Species** There are undoubtedly instances where food fishes which do not readily take baited hooks are protected at all times by laws which permit the taking of fish by angling only. In many waters, the presence of carp, suckers and other rough fish is a hindrance to the natural reproduction of the species which it is desired to encourage. In such instances, those administering the laws should have authority to remove, and to permit others to remove, such fishes under proper regulations. In other words, the farming of a body of water should be with a view to maximum annual production of the kind of fish crop that it is desired to produce. Fishes which are detrimental to that crop should be treated as vermin. Fortunately this sort of vermin, at the present time, is a valuable food resource, if made available. I do not imagine that you expected a dissertation on protection in connection with the subject of this address, but you will agree with me that regulations are as essential to the attainment of results as is fish culture in all its phases.

In the early days, those who were interested in fish culture or in re-stocking waters, knew less about the subject than they do to-day. Very few people realized the seriousness of introducing to certain waters fish which were not only not indigenous, but, in addition, were antagonistic to the native inhabitants of such waters. Consequently, many more mistakes were made in those days than are made to-day. When the trout became depleted in the northern states, especially in New England and New York states, it was discovered that the large-mouth bass and the small-mouth bass are very prolific and that the introduction of a few pairs into a depleted trout pond showed quick results. As a sequence bass were introduced into many trout waters. The bass increased rapidly and thrived until the few remaining trout were exterminated. When this food was exhausted, the bass, in some instances became a stunted race for the lack of food; in other instances, they furnished indifferent fishing. Some of these waters are of too small area and of too low a temperature to expect satisfactory results with the bass, which require large range and more food than the trout which they replaced, but the bass are there and what are we going to do about it? They do not easily respond to poison, as do many other species. If the pond or lake can be drawn down to a small area, either by excavation at the outlet or by siphoning, it may be possible to clean them out and start over again but this plan is feasible only in comparatively few waters. For other waters, we must accept the bass permanently and, in order to make the waters most productive, it is important to introduce some other species which will not only furnish food for the bass but will also produce food for the people who are not expert anglers. One of the commonest fishes to introduce has been the yellow perch. It is very prolific and good food fish and has the advantage of being easily caught by women and children.

**Discriminating Between Species** In many of the waters, such as I have described, pickerel have been introduced, usually by individuals. Trout waters which contain pickerel, but which do not contain black bass, may be restored to their former conditions by destroying the pickerel by the use of copper sulphate. In most instances, however, this is too large an undertaking, and, here again, the production of a lake may be increased by the introduction of yellow perch, and, if the waters are of large area, the pike perch may prove a valuable acquisition. Some of the waters which I have described, are fed by trout streams, and, if the waters are quite cold, the bass or other introduced enemies of the trout may not be so serious a menace to the latter, if the protective close season is not applied. In such instances, those most competent to judge should decide upon the species, which, under existing conditions, will produce the best results. In lakes of small area the native trout may be decided upon. In the larger lakes, lake trout or landlocked salmon or both may be selected. In some of the New England waters, the landlocked salmon has proved itself better able to cope with the spiney-rayed introduced species than any other species of *salmonidæ*, but it should not be introduced to waters in which it is desired to encourage the native brook trout. If it is decided to specialize with trout or salmon, the waters should be stocked annually with that species and suitable fish food introduced if food is lacking. The close season on black bass in waters selected for trout or salmon should be annulled or the open season should be the same as for the latter. In other words, do not protect two antagonistic species of fish in the same waters nor attempt to please the tastes of both the trout fisherman and the angler for bass by restocking the same waters with both species. Another way to encourage the trout in such a lake, and, at the same time, reduce the number of bass, is by screening the nests of bass fry before they scatter, making it possible to thereby effect their removal to suitable rearing waters or directly to waters in which it is decided to specialize with the bass. Some natural trout lakes may also contain yellow perch. It is a very simple matter to annually patrol the shallows of the lake during the spawning season of the perch and to take up and transfer the spawn of the perch to hatcheries or directly to waters where it is desired to encourage the perch. These suggestions with regard to the removal of bass fry or perch spawn are equally applicable to other species of fish, and it may readily be seen that, by carrying out this policy, one is not only conserving the trout, but is also conserving the young or eggs of some species of fish objectionable in that particular water, but very valuable in some other body of water.

In New York state, three species of trout are propagated, namely, native brook trout, the German brown trout and the rainbow or steelhead trout of the Pacific coast. Experience has shown that both the brown and rainbow trout are very destructive to the native trout, and yet they are valuable acquisitions to some waters which, during the summer, become too warm to meet the requirements of the native species.

In looking over the records of the past eighteen years, I find that one of the more important lakes in New York has been stocked with *thirteen different species of fish*. Without enumerating the species, you all know that it is impossible to expect successful results with so many species, and you also know that many of these species are antagonistic to each other. Undoubtedly, there were applications for all of the species that have been introduced. There is a tendency among anglers, who do not give a thought to the serious results which may follow, to ask for some new species which they have heard about, or which they have enjoyed catching in some waters to which they were native, and it is natural for Fish Commissioners to cater to the many tastes of the individual supplicants. It is impossible, however, to suit every individual in one particular water. The trout fisherman must go to the natural trout waters and the bass fisherman must go to the waters which are naturally productive of bass in order to obtain good fishing.

Lake Sunapee, in New Hampshire, is well known to anglers from almost every state in the Union. This lake also has received many species of fish. A letter to one of the former Commissioners of New Hampshire in regard to this lake elicited the following reply: "Fishing all gone; not a salmon **this** spring. The Chinooks were good for a time, but do not reproduce and have all been caught out. They have dumped lots of fish in the lake, but they seem to do us no good." I might go on giving specific illustrations of this kind indefinitely, but it is unnecessary. You all know the conditions of your own waters and whether you are propagating or protecting in the same water species which are antagonistic to each other.

**A Survey for Re-stocking** It becomes apparent that, in order to obtain the best results, a permanent policy must be established with regard to each stream, pond or lake which is to receive attention. In other words, a survey should be made of all waters which are to receive any attention in the way of re-stocking. The results of the survey should be published in such a way that the successors of those who establish the policy may have something to guide them in their efforts with reference to the same waters.

In New York state, a beginning has been made along these lines by investigation of the streams of Oneida county. Oneida has an area of 1,100 square miles and is drained by four river systems. The fish-producing power of these waters is unusually large. During recent years, several fish and game protective associations have assumed almost entire charge of the planting of these streams with trout, and, in most instances, it has been the custom for these associations to apply for brook, brown and rainbow trout for each public stream, notwithstanding the fact that it has been conclusively proven that brown and rainbow trout are very destructive to the native brook trout.

**DETAILS OF SURVEY.**—For the purposes of this study, each stream was examined in sufficient detail to ascertain its general character, and the prevailing conditions throughout its entire

length. The following were the main points investigated and reported upon:

- (1) Source, length, width, depth and water into which it empties.
- (2) Character of the bottom.
- (3) Rate of flow.
- (4) Colour and transparency of the water.
- (5) Vegetation in and along the stream and amount of shade provided.
- (6) Character of the surrounding country—whether timbered or open land and whether the stream is likely to be subject to drought, severe floods, or the inflow of a large amount of sediment from the watershed.
- (7) Temperature from source to mouth.
- (8) Headwaters and spring tributaries were located as possible planting points.
- (9) Obstructions to the migration of fish.
- (10) Points at which pollutions occurred and the character, amount and general effects of the pollution.
- (11) Presence of pools and side holes as places of shelter for fish.
- (12) Streams or sections of streams posted, and by whom.
- (13) The quantity and variety of food organisms for fish in the stream.
- (14) The kinds of fish present.
- (15) A few fish were taken from each stream for future stomach examination, in order to obtain more accurate data on the natural fish food.
- (16) As much local information as possible was obtained regarding the extent to which a stream is fished and the agencies available for carrying on systematic stocking and development.

RESULTS OF SURVEY.—1. A complete and detailed report along the lines outlined above has been prepared on each stream. This precise data has been put in convenient form for reference in the office of the Conservation Commission.

2. The names of persons and associations throughout the country having some interest or connection with streams or fish have been obtained.

3. The fish stomachs will give more accurate information as to the natural food of fish. The results of this phase of the investigation will be published later.

4. Upon the information obtained, working plans for a bulletin have been formulated.

Problems yet unsolved, such as pollution, posting, obstructions, and denudations came up on every hand. As the field work progressed, their importance was emphasized.

The working plan resulting from this investigation has proven most satisfactory. It has been found desirable to take the entire river system into consideration; not merely individual systems, for brown trout planted in one stream in the system will in time work

into the other streams unless prevented by dams or other obstructions. The change made as the result of these working plans will tend to eliminate much waste of the state hatchery products and to develop the streams of the county to their highest efficiency as fish producers. It is hoped that similar work may be done in other counties to the end that a permanent policy may be made as a guide, not only to the anglers and state authorities who have to do with the stocking of such waters, but also that the United States Bureau of Fisheries, in response to the applications for fish to stock the same waters, may act in unison with the State authorities with reference to the treatment of these waters.

In Vermont, a step in the same direction has been taken. On a copy of the State Highway map, the various lakes and ponds have been coloured in strong colours and numbered. A key to the map accompanies it, and, opposite each number, information is given as to the name of the pond, its present inhabitants, water area, whether the pond has been reservoired or not and the future policy as to the kind of fish to be introduced. If the state and federal authorities of the future adhere to this policy, a great waste of good material will be avoided.

The information as to whether a pond is reservoired or not is given for the guidance of prospective purchasers of shore property for summer homes. In some instances the reservoiring of lakes is harmless. The effect upon the fishing depends upon the extent of abnormal conditions created by reservoiring the waters and then drawing them down during the low-water seasons. On general principles, the lakes and ponds which are most unlikely to be reservoired and drawn down—in other words, the waters which are most likely to remain natural—are the ones in which the future fishing can be relied upon to be as good or better than it is now. It is a well recognized fact that the reservoiring of lakes for water-power purposes is detrimental to the fishing. For illustration, Rangeley lake in Maine has been raised twice and is now 18 feet higher than the natural level. As a result, the trout fishing in this, the most famous of the Maine lakes, has been gradually falling off ever since the water level was raised.

**Selection  
of Species**

It is quite generally recognized that for a few years, fishing has been improved by reservoiring a lake or pond—especially so if the waters are kept at the higher level—but this improvement in the fishing is rarely permanent.

The question of increasing the food supply to meet the crisis under present war conditions has led to recommendations which indicate that many people do not realize that fish caught by angling are food fishes, even though they are also catalogued as game fishes. It must be borne in mind, however, that many of our waters are better suited to the cultivation of so-called game fishes, like trout and bass, than they are for the species of fish commonly described as 'commercial' fishes.

To obtain permanent results when attempting to stock any body of water the selection of a proper species of fish is of the utmost

importance. The applicant should give sufficient information to guide the fisheries officials in the selection of the species of fish to be assigned. The preference of the applicant should be stated, but, unless it is a species which will produce most satisfactory results and be in conformity with a permanent policy, an explanation should be sent to the applicant as to why his preference is not approved and the reason for assigning some other species.

Planting  
Procedure

Next, if not equal in importance to a proper species of fish for stocking a given body of water, is the matter of fish planting. Ordinarily, it is left to the applicant to plant the fish. He is usually furnished with printed instructions how to plant them. Sometimes he reads these instructions; very frequently he does not do so. It is necessary, therefore, to have a campaign of education as to the importance of properly tempering the water when transferring the fish from the cans to the waters which are to be their permanent homes, and also respecting other important precautions for the attainment of successful results. It is almost impracticable for the authorities to supervise the planting of fish except in waters where large quantities of commercial fishes are being introduced. It is expected that the local anglers will be sufficiently interested to receive and plant the game fishes, but nothing but constant hammering will educate the applicants to persevere in their initial enthusiasm until they have actually put them into the waters in proper condition. If an applicant does not follow instructions and has not promptly and properly planted the fish when delivered to him, any further applications from him should be refused.

Planting  
Large Water  
Areas

I have been discussing a policy which refers to ordinary streams, ponds or lakes. The policy with regard to waters of large area may be varied somewhat from the permanent policy respecting the smaller lakes. The species to be selected for the larger lakes is dependent to some extent upon whether reliance is to be placed on artificial propagation to maintain the supply or whether, after stocking, a protective close season and natural reproduction are to be depended upon.

In this connection I have in mind some lakes twenty to thirty miles in length, in which there are such varying conditions in the different portions that the commission feels warranted in annually planting lake trout and pike perch—two species quite antagonistic to each other—while at the same time protecting the black bass, although the last named is destructive to the lake trout. In these waters, the carp, if present, should be annually netted at seasons most favourable for effecting their capture.

In any attempt to establish a permanent policy with reference to the selection of species for stocking a water system, it is apparent that the farm fish pond and the privately stocked and posted stream must be under Government supervision. It is obvious that the proper selection of species to be encouraged in these privately controlled waters must be made with reference to its effect upon the other fish in the public waters to which they are tributary. In this connection, permit me to say that we should encourage the fish

pond on the farm by furnishing fish to stock such private waters at cost, just as the State furnishes trees for reforestation at cost. Under proper regulations, the owners of artificial ponds which do not receive a supply of fish from public waters, but which are stocked at the owner's expense, should have perfect freedom to take the fish from these ponds at all seasons, but the waters should be under the supervision of the Fish Commission as to the species propagated when such ponds empty into public waters.

**Private Fish Ponds** Progress in the encouragement of farm fish ponds will never be what it ought to be until the public are educated to recognize private ownership of fish which are artificially propagated or privately controlled in privately-owned ponds. Public sentiment now is such that people will steal fish who will not steal umbrellas.

The owner of the private fish pond must also be encouraged and educated as to how to construct his pond and as to the results he may expect from the utilization of his waters. He should also be instructed as to the species of fish that will probably thrive best in the proposed pond. I recently had an inquiry from a man who wrote as follows: "I have a small lake of fresh running water. I would like to raise in it flounders, carp and pike; let me know whether these fish will stay in such waters." It is quite impossible to tell the inquirer what species of fish will be most productive in his pond until he has answered a series of questions as to area, nature of water supply, maximum water temperature, etc., but it is apparent to all of you that the flounder must have salt water, that the lake is probably of too small area for the successful production of pike, and that it is quite likely that in the latitude of New York some species other than the carp may prove more satisfactory. Another inquirer asks "for young fish for a lake 75 ft. x 175 ft. and expressed a preference for pickerel, bass, trout and white perch. One cannot, offhand, make recommendations for the kind of fish suitable for this little pond, one-third of an acre in area.

**Summary** (1) In the present crisis, conservation of our fishing resources is of greater importance than at any previous time in our history and proper regulations for the protection of fish are as important as is fish propagation.

(2) The retention in office of men conversant with the propagation and protection of fishes is essential to insure the best results.

(3) The farming of our waters should be with a view to obtaining the maximum annual production of the kind of fish crop upon which, after careful investigation, it is decided to specialize.

(4) The selection of species for planting in any water system should be determined with reference to a permanent policy in the hope that the successors of the officials now in control will continue the policy when it has been established.

(5) A campaign of education as to the importance of care in fish planting is of utmost importance in order to save wastage.

(6) The public should be taught to appreciate private property rights in fish when privately propagated entirely under the control of the owner.

(7) The introduction of any species of fish foreign to the waters should be prohibited except when approved by experts.

(8) The Fisheries authorities should have power to market rough fish at any time and to exterminate them by any means, either directly or by the issuance of licenses. By rough fish is meant the species of fish which are antagonistic to the maintenance of a successful, permanent policy already decided upon. As to statistical results, it is immaterial whether fish are taken by net or with hook and line. *How* fish are to be taken should be regulated to suit local conditions and with reference to the effect upon property values. In this connection, the value of recreation must not be underrated.

(9) Finally—Build for the future generation, regardless of present political conditions. Leave a monument for yourselves by setting an example for your successors, whether of the same political faith or not. Set a pace for them and turn over to them such complete records of your work that they can have no excuse for failure to adhere to the permanent policy which may be established under your guidance.

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## APPENDIX VI

### Buying Combinations in the Metal Market\*

**CLOSE INTERRELATION OF PRODUCERS, TRADERS AND LARGER CONSUMERS**—Before the war, the control of the world's metal market was in the hands of a group of German metal traders who are primarily engaged in buying metal, or in acting as selling agents for producers, and in selling it to European and Asiatic consumers. From the standpoint of the American metal producers, they are to be regarded primarily in the light of buyers, although in a broader sense they might well be defined as traders, since they both buy and sell. The description of their activities here given is from the American point of view. In a general way, it may be said that in Germany is centred the control over many of the largest producers of metals, while the London Metal Exchange and silver 'fixing board' exercise and control the price-fixing power to such a degree that London has become the international market for almost all metals, and that London metal quotations set the standard for the metal business the world over.

With regard to the fixing of prices in the metal market, the national and international metal cartels and syndicates are of primary importance. The metal trade is notable for the extraordinary degree in which it has been concentrated in the leading metal-producing and metal-consuming countries of the world. A comparatively small number of firms control this trade the world over, and most of them are more or less closely inter-related. These combines fix the price and regulate the production of the metals and metal products controlled by them in their respective territories, and thus indirectly have an important bearing on the price question as it affects the metal market. The part played by the banks in the control of the metal business is largely responsible for the internationalization of the metal trade. Through syndicate agreements, price cartels, and interlocking directorates, certain banks of England, Germany, Holland, Switzerland, and Belgium have managed to secure control over the largest metal plants and metal-selling agencies of the world.

Another interesting feature of the metal combines consists in the fact that a number of large and important industries are dependent upon the metal trade for their supply of raw materials. Among these the electrical and the chemical industries rank foremost.

\*This is an extract from the report of the United States Federal Trade Commission on *Co-operation in American Export Trade* (Washington, 1916) and is reproduced here in connection with Sir Clifford Sifton's reference on page 17 of this report, to the alleged enemy affiliation of the company controlling the patents of the flotation process of concentrating ore. It is also of interest in regard to Canada's policy after the war on the export of nickel, referred to on page 16.

Almost half of the total copper production is used for electrical purposes.

This close interdependence as well as manifold other common interests have been instrumental in bringing about a far-reaching system of co-operation among the leading metal firms and industrial cartels and syndicates. Thus, the Metallgesellschaft of Frankfurt a. M., before the war was the common selling agency for the French Aluminum Syndicate, and it serves in a similar capacity, together with Beer, Sondheimer & Co., of Frankfurt a. M., and Aron Hirsch und Sohn, of Halberstadt, for the German Zinc Syndicate. Aron Hirsch und Sohn are members of the German Copper Sheet Syndicate and of the Combine of German Copper Wire Works. The Deutsche Gold-und-Silberscheideanstalt is closely allied with the chemical industry and is a member of several chemical cartels. In 1900 it organized and managed a syndicate of calcium-carbide manufacturers. In the latter industry, the Siemens-Schuckert concern, one of the groups that control the German electrical business, is heavily interested. By means of the Metallurgische Gesellschaft the Merton interests, which are the chief factor in the metal buying combination, acquired large holdings in the German potash industry through the Gewerkschaft Rastenberg.\* On the accompanying chart the number and extent of these interrelations is presented.

Through banks, holding companies, affiliations with syndicates and cartels, interlocking directorates, joint-share holdings, and other means of interrelation, a world-wide ramification has taken place in the metal trade.

The following examples will illustrate how some of the more important metal concerns are allied through interlocking directorates. Of the Merton family, of Frankfurt and London, five members are directors in most of the companies controlled by or affiliated with the Metallbank of Frankfurt, a. M.; R. Merton is connected with the Merton Metallurgical Co., London; the American Metal Co. (Ltd.); the Australian Metal Co. (Ltd.); and the Compagnie des Minerais de Liège. Walter Merton is a director of the Metallbank & Metallurgische Gesellschaft, Frankfurt a. M.; the Metallgesellschaft, Frankfurt a.m., and of the Merton Metallurgical Co., London. H. Gardner is on the board of directors of Henry R. Merton & Co. (Ltd.); the Australian Metal Co.; the Merton Metallurgical Co., London; the Mines de Pierrefitte (Ltd.), and Williams, Foster & Co. A. Ladenburg is a director of the Metallbank and of the Schweizerische Gesellschaft für Metallwerke. Walter vom Rath is a director of the Metallbank, the Metallgesellschaft, the Lahmeyer electrical concern, the Höchster Dye Works, and the Allgemeine Electrizitäts Gesellschaft.

The Frankfurt metal firms are also connected with some of the leading German banks through interlocking directorates, viz., the Hirsch concern with the Deutsche Bank; the Deutsche Gold-und Silberscheideanstalt with the Metallbank, Frankfurt, a. M., and the Oberschlesische Zinkhütten A. G., Kattowitz, with the Nationalbank für Deutschland.

\*H. A. Giebel Die Finanzierung d. Kaliindustrie (Karlsruhe), 1912, p. 120 fol.

*Silver*.—According to the statement of a large American concern, which exports about seven-tenths of its silver output to London, the silver trade of the world is dominated by the London Metal Exchange.

"The price of silver is fixed in London by what is termed publicly the 'fixing board,' which consists of four banking or brokerage houses dealing in silver and eastern exchange. This board of four representatives meets at a quarter past two every afternoon. This permits prices to be made in New York at the opening of business here, on account of the difference in time. Since virtually the entire silver business of London is in connection with exportations from the United States, it will be seen that the meeting time in London is after the members of the fixing board know the full receipts and demands in London, but before business opens in New York. All silver in London is sold through these members of the fixing board. The distribution of silver in London is, as stated above, approximately 75 per cent for shipment to the East, which is sold entirely to eastern banking representatives, both English and continental, for coinage purposes, and, to a minor extent, to the manufacturers of silver. The eastern banks and the government representatives will not buy through anyone except members of the fixing board, and at the fixed prices, because if they do otherwise they take a responsibility which they do not seem to be willing to take. In fact, if they should buy in any quantity from other parties, the fixing board would probably fix a price that would make their purchase open to criticism. These four brokers, therefore, have the ability, and exercise it, to absolutely fix every day the price at which the entire product of the mines of the United States in silver has to be sold.

This fixing board has, however, a much greater power than that covered by the actual transactions in fine silver, for the reason that the commerce of the East, India, and the Straits Settlements and China is expressed in silver; in other words, the entire exchange transactions of London, covering the entire commerce between the continent of Europe and India, is expressed in silver values, and the price of silver is the price of exchange. These exchange transactions are at least ten times as great as the total value of silver purchased and sold in London. The great eastern banks are the great buyers not only of silver for export to the East but also of the exchange covering the commerce with the East. The silver value of the American mines is dominated not only by the London situation as to silver but also the London situation as to their commerce with the East, and the whole situation is dominated by four brokers, designated as a fixing board."

*Copper*.—According to the statement of a large American concern, which exports about six-tenths of its copper output to Europe, prices established by the London Metal Exchange determined to a large extent prices of copper at any port in Europe. Since the present war, the British director of materials promulgated the following regulations in relation to sales of copper:

(1) Orders up to and not exceeding 50 tons may be placed in the usual way, without reference to the minister of munitions.

(2) No orders for best selected or electrolytic brands of copper shall be placed at prices exceeding £100 per ton, without first consulting the director of materials.

Commenting on the effects of this order, the American concern said:

"This action was taken January 5 last. The immediate effect of this action with reference to copper was to stop the buying. The British Government, stating that they were acting also for their allies, Russia, France, and Italy, had previously negotiated large purchases of copper in this country for delivery spread out over a year. A very large proportion of the amount of copper exported is now being purchased by Governments, all acting in conjunction with one another, and is being distributed by these Governments to their manufacturers. Furthermore, we know that our sales of copper, made to the largest consumers of copper in France, are being distributed by them to their normal competitors at the present time.

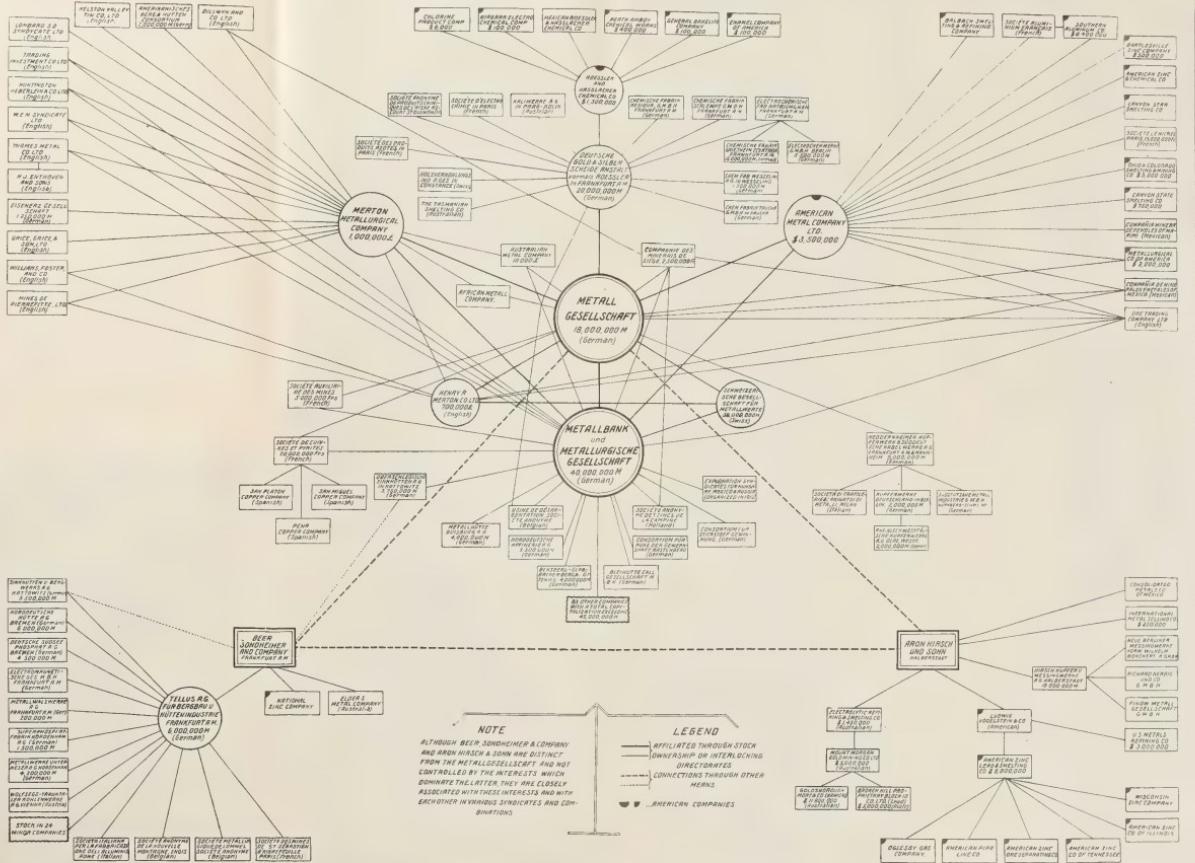
On the subject of the purchase of copper by German buyers before the war, the American concern stated:

"The German consumption was such a large proportion of the total amount of copper exported that German buyers had more influence in fixing the value of copper than the English buyers. It was very evident to this company that the buyers of Germany at least worked as a unit. They would repeatedly remain out of the market for weeks at a time and would not accept any offer made, during which time the American sellers would accumulate such amounts of copper that they would be obliged to reduce their offers. The German buyer would wait until the offers were reduced sufficiently and then would come in again as the unit and buy in very large quantities. This process of buying at the lower and refusing to buy at the higher price, which was naturally stimulated by their very heavy buying at the low price, resulted in the average price of export copper being considerably lower than the average price at which the American buyer, who bought more regularly and was more inclined to buy at the panic high prices, could buy. The result is, so far as the sales of this company are concerned, and we believe that there is a similar condition on the part of other sellers of copper for exportation, the average export price is considerably lower than the average price obtained from the American consumers. This difference arises entirely from the selection as to the time of buying and not from the holding of a price at any one time by this company to American consumers above that offered to consumers abroad."

On conditions in the German market since the war began, the American concern said:

"In Germany at the beginning of the war, a combination of all the large German consumers and metal merchants was made, known as the Kriegsmetall Gesellschaft. This combination has assembled and distributed the copper supply of the country. This

#### **THE GERMAN METAL BUYING COMBINATION**



ALTHOUGH BEER SONDEIMER & COMPANY AND ARON HIRSCH & SONS ARE DISTINCT FROM THE METALLGESELLSCHAFT AND NOT CONTROLLED BY THE INTERESTS WHICH DOMINATE THE LATTER, THEY ARE CLOSELY ASSOCIATED WITH THESE INTERESTS AND WITH EACH OTHER IN VARIOUS SYNDICATES AND COM-

**LEGEND**

- AMERICAN COMPANIES**

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is recognized as an incident of the war, but we are now informed it is proposed to continue this combination after the war is over. It would thoroughly and effectively combine all of the large tonnage of copper which has heretofore been purchased in this country and place the American producers at a tremendous disadvantage. In Germany there are interlocking directorates, with large financial interests holding shares in the companies that are largest consumers of copper, which enables the management of the respective companies to act jointly in purchasing their requirements of copper in this country. The United States has heretofore supplied most of the copper used in Germany, and Germany has been the largest consumer in Europe."

The bearing of the conditions existing in the European markets on the copper industry in the United States may be understood when it is realized that the United States produces about 56 per cent of the world's supply of copper and exports about three-quarters of its annual production. In the year ending June 30, 1914, it exported 975,000,000 pounds, valued at \$145,000,000, seven-eighths of the exports being in the form of pigs, ingots, and bars. Of the total quantity of exports, 96 per cent went to Europe. Germany took one-third of the exports to Europe. In addition to the quantity purchased by the great German metal-buying combinations, headed by the Metallgesellschaft, many of the large consumers of copper acted in concert in their purchases, through their cartel arrangements. According to one large American copper-producing company, they had reports from their Berlin agent of the existence of more than 50 combinations of copper-consuming companies for the regulation of prices, distribution of territory, and for concerted action in buying. According to John D. Ryan, of the Amalgamated Copper Co., European buyers, from 1903 to 1913, because of a buying combination, paid 83/100 of a cent per pound less for copper delivered abroad than domestic buyers for copper delivered at New York.

*Zinc.*—The German zinc syndicate (*Zinkhüttenverband*) was organized in February, 1909, with a capitalization of 2,000,000 marks, for the apportionment of the output and for the fixing of the sales prices of zinc. The active organizers of the syndicate were the Metallbank of Frankfort, controlled by the Merton interests; the Frankfort metal selling and holding company, Beer, Sondheimer & Co., which, through the Tellus joint-stock company, controls over a dozen metal and chemical concerns; and the firm of Aron Hirsch und Sohn, in Halberstadt. Both the latter metal dealers established their own new zinc works at the moment of the organization of the German zinc syndicate.\*

Seven zinc works of Silesia and six zinc concerns of the Rhenish-Westphalian region at once joined the syndicate. The Metallbank, Beer, Sondheimer & Co., and Aron Hirsch und Sohn were made the exclusive selling agencies of the syndicate and the agreement was to continue for three years. Only one important concern, the Georg

\**Kartell-Rundshau*, 1909, p. 279.

von Giesches Erben, retained its right to deal directly with the consumers, under the condition, however, that it should comply with the price lists of the syndicate.<sup>a</sup>

Immediately upon the organization of the German Zinc Syndicate (Zinkhüttenverband) an agreement was made with the Austrian and Belgian producers, of which the Vieille Montagne had works in Belgium, France, Algiers, Germany, Italy, England, Sweden, and Spain, and agencies in Tunis, America (United States), Japan, and Turkey. A Dutch concern (Zincs de la Campine) also joined the syndicate.<sup>b</sup> The syndicate embraced altogether 18 firms.

Ten Belgian and some French works formed another syndicate; so did six English works. During the same year, 1909, the competition of the United States concerns drove all these three groups together into the International Zinc Syndicate (Internationaler Zinkhüttenverband).<sup>c</sup>

The International Zinc Syndicate was continued on November 10, 1910, up to April, 1914. The syndicate agreement left the English and the French works free to fix their prices, and it is said that in some cases they underbid the German works.<sup>d</sup> The agreement also provided that in case the reserve had reached 50,000 tons and the zinc prices in London had gone below £23 per ton, the output should be reduced. Before the outbreak of the present war, a 20 per cent reduction of output was ordered.

The price changes made by the German Zinkhüttenverband always correspond to those made by the International Zinc Syndicate for the London Metal Exchange, which, it is said, gets its instructions from the Metallbank of Frankfort, i.e., from the combined Merton, Beer, Sondheimer & Co., and Aron Hirsch und Sohn interests. The zinc and other metal dealers of Germany act in unison as purchasers from any foreign concern.

By the end of 1912, the German Zinkhüttenverband controlled one-half of the world's output of zinc and three-fourths of the European output.<sup>e</sup>

The International Zinc Syndicate regulates output only, while the German syndicate (Zinkhüttenverband) regulates both output and prices within its sphere. The actual price regulation is carried out by the Kölner Zinkhüttenverband<sup>f</sup> which appears to be but a subdivision of the German syndicate (Zinkhüttenverband). It must be remembered that the German syndicate has two distributing agencies—one in Cologne and the other in Kattowitz (Silesia). The published price quotations, however, do not represent strict sales prices, but form only the basic price on which the actual sales prices are computed.<sup>f</sup>

*Lead.*—In 1908, an agreement was reached between German lead works and Australian lead-mine owners as regards prices and

<sup>a</sup> *Ibid.*, p. 646.

<sup>b</sup> *Ibid.*, p. 280.

<sup>c</sup> A. Stange, *Die Montan-Industrie Deutschlands* (Berlin), 1910, p. 120.

<sup>d</sup> *Kartell-Rundschau*, 1914, p. 790.

<sup>e</sup> *Kartell-Rundschau*, 1913, p. 607.

<sup>f</sup> *Ibid.*, p. 1005.

apportionment of markets. The competition of Spain and of the United States compelled the lead interests to organize in the spring of 1909 the International Lead Convention. The Australian Broken Hill mines, the American Smelting & Refining Co., some Spanish and some Mexican mines, the Usines des Désargentation of Antwerp, and the German Bleihütte 'Call' formed a common sales agency under the leadership of the Metallgesellschaft in Frankfurt, a.M., in Germany, and of the Henry R. Merton & Co., in London. This convention was continued in June, 1910, for several years.<sup>a</sup>

*Aluminum.*—Close relations exist between the Merton concern and the aluminum industry, especially the French Aluminum Syndicate, and through the latter with the International Aluminum Cartel formed in 1912. The Metallgesellschaft of Frankfurt, a.M., was instrumental in organizing the French Aluminum Syndicate in November, 1910, and since then it has served in the capacity of its common selling agency, which handles the entire export of the French Aluminum Syndicate. The following companies are members of the French syndicate: Société Electro-Métallurgique Française ('Froges'), Compagnie des Produits Chimiques d'Alais et de la Camargne ('Salindres'), Société des Forces Motrices et Usines de l'Arve, Société des Produits Electro-Chimiques et Métallurgiques des Pyrénées, Société Electro-Métallurgique du Sud-Est, and the Société d'Electrochimie.<sup>b</sup>

Several aluminum factories also manufacture calcium carbide, and in 1900 the Deutsche Gold-und Silberscheideanstalt organized and managed a syndicate of calcium-carbide producers, which was dissolved in the following year. An international carbide syndicate was formed in 1910 for a period of 10 years, of which all of the 58 carbide factories of Europe (in France, Switzerland, Germany, England, Austria, Norway, and Sweden) became members.<sup>c</sup>

The electrical industry has for many years been closely connected with the manufacture of calcium carbide, especially the Schuckert interests.<sup>d</sup>

In October, 1910, the following German producers organized the German Aluminum Purchasing Association<sup>e</sup> (Deutsche Aluminium Einkaufsvereinigung):

Fried. Krupp-Grusonwerk, A. G.; Julius & August Erbslöh; Karl Berg in Eveking; Vereinigte Deutsche Nickelwerke in Schwerte; Th. Goldschmidt in Essen; and Basse & Selve, Lüdenscheid.

Through this purchasing combine, the metal industry was connected with the Krupp concern, the great steel, ship-building, ordnance, and munition manufacturers, on the one hand, and with the copper and brass industry on the other. Basse is one of the directors of the Lüdenscheider Metallwerke, A. G., Vormals Jul.

<sup>a</sup> L. Silberberg, *Kartell-Jahrbuch*, 1910, p. 30.

<sup>b</sup> C. Dux, *Die Aluminium-Industrie* A.—G. Neuhausen, p. 32; W. Kossmann Ueber d. wirt. Entw. der Aluminiumindustrie, 1911, pp. 30, 52, 117: *Kartell-Rundschan*, 1911, p. 60.

<sup>c</sup> *Kartell-Jahrbuch*, 1910, 3, p. 83.

<sup>d</sup> P. Wangemann, *Die Calciumcarbidindustrie* (Dresden), 1904, pp. 75 fol.

<sup>e</sup> L. Silberberg, *Kartell-Jahrbuch*, 1910, V. I, pt. 4, p. 37.

Fischer und Basse,<sup>a</sup> a large consumer of metals, and a producer of fine machinery and various articles from copper, brass, and new silver. American metal exporters state that the Lüdenscheider Metallwerke, A. G., are also closely connected with the Metallbank of Frankfurt.

### The German Metal-Buying Combination

There are three main groups of interests which together dominate the German metal market. They are the group identified with the Merton family, including the Metall Gesellschaft, the Metallbank and Metallurgische Gesellschaft, and the Deutsche Gold- und Silberscheideanstalt, the group identified with Beer, Sondheimer & Co., and the group identified with Aron Hirsch und Sohn. The principal relationships of these three groups are shown on the chart.

**THE METALLGESELLSCHAFT, METALLBANK UND METALLURGISCHE GESELLSCHAFT, AND H. R. MERTON & CO., LTD.**—The Metallgesellschaft, A. G. Frankfurt a. M., was founded in 1881 by Wilhelm Merton. It took over the metal business of his grandfather Philipp Abraham Cohen.<sup>b</sup> Wilhelm Merton was the son of the senior member of the firm of Henry R. Merton & Co. of London. When R. H. Merton started in business, P. A. Cohen supplied part of the capital, conversely, later on, H. R. Merton and his brothers Zachary and Emile, who had later become associated with him, also had a proprietary interest in the Cohen concern. When the two concerns were formed into limited companies these interests were capitalized in the form of shares in H. R. Merton & Co., Ltd., and in the Metallgesellschaft, A. G. Frankfurt a. M.<sup>c</sup> In 1878, the London and the Frankfurt interests had already joined in the foundation of the American Metal Co. As a result of the predominance of the influence of the Merton family in these three companies, they have been generally known as the 'Merton concern.'

For the purpose of attracting outside capital, and in order to distribute the risk entailed by large investments, participating and financing companies were formed. The first step in this direction was that the Frankfurt, London, and New York firms turned over to separate holding companies their interests in mines and smelting plants which they had acquired in the course of time. In this way, in 1897, there was formed, as a subsidiary company associated with the Metallgesellschaft, the Metallurgische Gesellschaft, Frankfurt a. M. (capital 6,000,000 marks); in 1907, as a subsidiary company associated with the American Metal Co., the Metallurgical Co. of America (capital \$2,000,000).<sup>d</sup>

As the sphere of business interests of the Merton concern expanded into other countries outside of Germany, England, and the United States, the following additional holding companies were

<sup>a</sup> Handbuch der Börsen-Werte, 1913-14, V. II., p. 2353.

<sup>b</sup> The precious metal business was taken over in 1873 by the Deutsche Gold- und Silberscheideanstalt.

<sup>c</sup> The Ironmonger, Mar. 18, 1916, pp. 44-45 (see also article by Prof. Robert Liefmann in Weltwirtschaftliches Archiv for January, 1913).

<sup>d</sup> R. Liefmann, in Weltwirtschaftliches Archiv. for January, 1913.

organized; The Compagnie des Minerais, Liège (capital 2,500,000 francs); the Société auxiliaire des Mines, Paris (capital 5,000,000 francs); and the Compañía de Minerales y Metales, Mexico. Together with the French banks, Cahen d'Anvers,<sup>a</sup> the Société générale pour favoriser le développement du Commerce et de l'industrie en France,<sup>a</sup> and other capitalistic groups, the Société des Cuivres et Pyrites, Paris (capital 30,000,000 francs), was organized in 1907 for promoting the development of three Spanish copper companies, the San Platon, the San Miguel, and the Pena Copper Company.<sup>b</sup>

Two subsidiary companies of the Metallgesellschaft and of Henry R. Merton & Co. are the African Metal Co. and the Australian Metal Co. of London and Melbourne, respectively. They attend to the purchase and sale of metals in their respective parts of the world in behalf of the two parent concerns.<sup>b</sup>

In 1906 the Berg- und Metallbank A.G., located at Frankfurt, was organized with a capital of 40,000,000 marks. This holding Company was founded by the Metallgesellschaft, together with the Metallurgische Gesellschaft, the Deutsche Gold- und Silberscheideanstalt,<sup>c</sup> the Darmstädter Bank,<sup>d</sup> the Berliner Handelsgesellschaft, the Diskontogesellschaft,<sup>d</sup> and several private bankers of Frankfurt. From one-quarter to one-third of the capital in the principal undertaking of the Merton concern was turned over to the Berg- und Metallbank. In 1910, the Berg- und Metallbank A.G. was consolidated with the Metallurgische Gesellschaft into the Metallbank und Metallurgische Gesellschaft A.G., Frankfurt a. M., with a capital of 40,000,000 marks.

A chart showing the principal inter-relationships of the various companies in the group which centre in the Metallgesellschaft and the Metallbank und Metallurgische Gesellschaft has been prepared by the Commission, and is reproduced herewith. A preliminary chart was first prepared from information derived from a large number of published sources, chief among which were the article by Prof. Robert Liefmann in the 'Weltwirtschaftliches Archiv' for January, 1913, various articles in the 'National Review' (London), the 'Mining and Engineering Review' (Melbourne), and other periodicals. The preliminary chart was then submitted for criticism to a number of Americans who are well informed in regard to the international metal situation and are acquainted with the organization, operation, and control of the companies shown on the chart. A final chart was then prepared, embodying the changes that were found to be desirable, in the light of the information gathered through such co-operation. The Commission believes that the chart herewith presented shows the principal companies and their inter-relationships, as they existed at the time of the outbreak of the present war. It is generally understood that, as a result of the

<sup>a</sup> Not shown separately on chart.

<sup>b</sup> R. Liefmann, in *Weltwirtschaftliches Archiv.* for January, 1913.

<sup>c</sup> For a description of the Deutsche Gold-und Silberscheideanstalt see p. 20.

<sup>d</sup> Not shown separately on chart.

war, there have already been a number of changes in such relationships, and that more are likely to take place.

It should be noted that the relationships shown on the chart indicate either stock control, stock inter-ownership, interlocking directorates, or syndicate connections. These relationships, the Commission is informed, are of such a nature that they lead to a centralized price control and to a harmony between the policies followed by the different companies in their purchases of metals. Connections also exist with other companies, but these have not been put on the chart because the Commission does not understand that they are effective in price control.

In the group of companies which are largely the outgrowth of the Merton concern, the dominating place has been held by the Metall Gesellschaft, the Metallbank und Metallurgische Gesellschaft, and the H. R. Merton & Co., Ltd. The affiliations of these companies through stock ownership and interlocking directorates is so close that it is difficult to determine which company is the dominating concern. The two largest subsidiary companies are the Merton Metallurgical Co. and the American Metal Co., Ltd. Apart from these two companies and their subsidiaries, the chart shows connections between the three controlling companies and 24 companies (excluding the Deutsche Gold- und Silberscheide group). Most of the connections were through stock ownership, either alone or in connection with interlocking directorates. In addition, mention is made of the fact that similar relations exist with 83 companies whose names are not separately shown.

While the chart shows 13 companies related to the central group through the American Metal Co., and a like number related through the Merton Metallurgical Co., attention should be called to the fact that many of these 28 companies are, at the same time, connected with one or more of the central group and with other companies directly connected with it. In all, the chart shows the names of 54 companies of the 137 companies (excluding the Deutsche Gold- und Silberscheide group), of whose inter-relation to the Metallgesellschaft the Commission has information. Among the important companies not mentioned on the chart in which the Metallbank und Metallurgische Gesellschaft holds shares are the Société des Anciens Etablissements 'Sopwith' of Paris and Linares, the bank of Delbrück Schickler & Co. of Berlin; the Mittledeutsche Versicherungs, A.G., Düsseldorf; the Allegemeine Revisions und Verwaltungs, A.G. Berlin; the Solotwina Naptha, G. m.b. H., Lemberg; the Österr. Petroleum-Industrie, A.G., Vienna.

THE DEUTSCHE GOLD- UND SILBERSCHEIDESTALT.—In 1872, the Deutsche Gold- und Silberscheideanstalt was established by the firms of Fr. Roessler Söhne and Hector Roessler, and in 1873 took over the precious metal business of Philipp Abraham Cohen.\* Close relations exist between the Merton interests and the Deutsche Gold- und Silberscheideanstalt, which is itself a widely ramified

\*The rest of the metal trade of Philipp Abraham Cohen was acquired by the Metallgesellschaft (see p. 365).

concern, is interested mainly in the chemical industry, and serves as the central agency for several cartels, among them the Convention of Manufacturers of Potassium Ferrocyanide,\* the Convention of Manufacturers of Potassium Cyanide,\* and the Convention for Quinine and Quinine Salts.\*

On the chart the connections in the nature of either stock-ownership, interlocking directorates, or both are shown between the Deutsche Gold- und Silberscheideanstalt and 20 minor companies. The direct connections shown are principally through stock-ownership. In addition to the connection shown on the chart with the Metallgesellschaft, the Commission has information concerning a number of inter-relations between companies of the Deutsche Gold- und Silberscheideanstalt group and those of the Metallgesellschaft, Metallbank und Metallurgische Gesellschaft, and H. R. Merton Co., Ltd., group, which it is not practicable to present diagrammatically.

ARON HIRSCH UND SOHN.—The firm of Aron Hirsch und Sohn, of Halberstadt, is an important unit in the international metal trade around which numerous subsidiary and otherwise related companies are grouped. It is also closely associated with a number of German and international cartels. It is one of the three selling agencies of the international zinc syndicate of Germany. It is a member of the German Copper Sheet Syndicate, Cassel,† and of the Combine of German Copper Wire Works, Cologne.† It holds an interest in the firm of Paul u. Siegbert Lachmann,† the copper mine Ilsenberg am Harz,† and the brass works Eberswalde on the Finow Canal.\* It controls the Hirsch, Kupfer- und Messingwerke, A.G., in Halberstadt (capital 10,000,000 marks), which manufactures chiefly copper and zinc products for railways, shipbuilding, and military purposes. The firm of Hirsch, Kupfer- und Messingwerke holds an interest in the Berlin Brass Works, Wilhelm Borchert, Jr., G. m. b. H. (capital 1,000,000 marks), and in the Rich. Herbig & Co., G.m.b.H., Berlin, and controls the Finow Metal Co., Ltd.

In Australia, Aron Hirsch und Sohn are interested in such important metal enterprises as the Electrolytic Smelting & Refining Co., and the Mount Morgan Gold Mining Co., Ltd., one of the largest Australian copper-producing companies. Through the latter company, Aron Hirsch und Sohn are connected by common directors with Goldsbrough Mort & Co., bankers and brokers and with the Broken Hill Proprietary Block 10 Co., Ltd. The international ramifications of the Hirsch interests also extend to numerous companies in the United States and Mexico. The firm of Ludwig Vogelstein & Co., New York, of which the firm of Aron Hirsch und Sohn is a special partner, serves as intermediary between the Hirsch interests and several of the American companies. The chart shows the names of 19 companies which are connected directly or indirectly with the firm of Aron Hirsch through interlocking directorates or stock-holdings.

\*Not shown on chart.

†Not shown separately on chart.

BEER, SONDHEIMER & Co.—The firm of Beer, Sondheimer & Co., Frankfurt a.M., is the centre of another large group of enterprises in the international metal trade, and ranks next in importance to the Merton concern, with which it has certain interests in common. In 1906, Beer, Sondheimer & Co. founded the Tellus A.G. für Bergbau und Hüttenindustrie. This company in turn controls, through stock-ownership, or interlocking directorates, 36 other companies, the names of 12 of these concerns being shown on the chart. Beer, Sondheimer & Co., also are connected with the National Zinc Co. (New York), and the Elder's Metal Co., of Australia. The international character of its business is seen from the fact that in the group are German, Austrian, Italian, Belgian, French, American, and Australian companies.

## APPENDIX VII

### Protest re Private Power Development at the Coteau Rapids

**SIR CLIFFORD SIFTON**, on behalf of the Commission of Conservation, on October 22nd, 1917, addressed to the Minister of Public Works, Ottawa, the following protest respecting the proposed development of power by the Power Development Company, Limited, at the Coteau rapids in the St. Lawrence river:

SIR:

October 22, 1917

The Commission of Conservation has the honour to address you on the subject of an application of the Power Development Company, Limited, made in pursuance of a notice published in the Canada Gazette on September 22, 1917. It is understood that this application will come before you on the 22nd October instant.

The application is for liberty on the part of the Power Development Company, Limited, to carry out a water-power development scheme in the Coteau rapids in the river St. Lawrence as a private, commercial undertaking. It is understood that plans and specifications of the proposed development have been filed in your Department.

Incidentally, the application contemplates the use of the dam which has been constructed by the Government between Clark island and Grande île. The right is also asked to use the entire water flow from lake St. Francis less any rights previously conceded or any water required by the Government for canal purposes or lockage of vessels.

Nothing in the application indicates that the applicants contemplate the idea of offering to pay any sum whatever for the extensive privileges which are asked for or to compensate the Government for the expenditure upon the dam, which the applicants propose to appropriate for their purposes.

It is presumed that the applicants are asking for the privileges mentioned in their application for the purpose of carrying out a purely private, commercial undertaking, and that, after the application is granted by the Minister of Public Works, the enterprise will be carried out as a commercial enterprise and the power which is developed will be disposed of by the company wherever it can be disposed of to the company's best advantage from a financial standpoint without regard to the interests of the Canadian public.

A great many considerations arise in connection with such an application at the present time. It is to be noted, for instance, with respect to the power situation at the city of Montreal, that the company which has heretofore been given the right to make use of the Cedar rapids for purposes of power development has developed and marketed a very large amount of power, estimated to be about 100,000 h.p. Of this amount of power, so developed purely from Canadian waters, the said company has sold and

delivered to the Aluminium Company of America an amount of power varying from 50,000 to 74,000 h.p., having been authorized to do so by permit issued on April 1, 1916, which authorized the said Cedars Company to export up to 100,000 h.p. This enormous quantity of energy is being sent out of Canada and is of no benefit whatever to Canada, except in so far as the profits thereon represent dividends to a few shareholders of the power company. It is obvious, therefore, that whatever the power situation is in Montreal, there can be no shortage which is legitimately due to lack of power development. If a shortage exists, it exists because this great quantity of power has been permitted to be exported to the United States. Moreover, it is stated that the extensions of plant now under way by the Cedars Company will produce an additional 100,000 h.p., or thereabouts, which will be available for use in a short time.

This is not the first time a proposal to dam the St. Lawrence has been up for consideration. In the year 1910, a company, which was believed to have been acting in the interests of the Aluminium Company of America, sought the power to dam the St. Lawrence river at the Long Sault, and the whole subject was most exhaustively considered in connection with that application. A hearing was had before the International Waterways Commission and protests against the project were then developed at length. Eventually, the matter came before Parliament and the whole subject was very exhaustively debated with the result that the company's application failed, and nothing has been heard of the project again until the present application was filed.

There is nothing in the papers before you which really indicates who the responsible parties are that are filing the present application or for what purposes the power which it is contemplated to develop will be used. The company has been incorporated under the plan known to lawyers as an office company, the incorporators being the officials of a law firm in Montreal, and the capital, \$500,000, is altogether inadequate for carrying out so ambitious a project.

Obviously, definite information should be furnished as to who are the responsible promoters of the project and what disposition it is proposed to make of the power which will be developed.

When the application heretofore referred to was up for consideration, the Commission of Conservation filed an objection before the International Waterways Commission in which the whole subject was discussed. The position was then taken that it was unwise and improvident to allow large Canadian water powers to be developed with the object of exporting the power to the United States, because, although there might, at the moment, be no commercial demand for the power in Canada, the time will undoubtedly come when the power will be required upon the Canadian side of the line. If, in the meantime, power has been exported to the United States and industries have been built up and vested interests created in the United States on the basis of the use of this power, a situation has been created which will give rise to serious embarrassment. The industries and interests thus created are

certain to look upon any attempt to withdraw the power from them as confiscation of their vested rights. They are quite certain to protest vigorously to their Government against such withdrawal being permitted, and serious international complications may arise.

We are informed that a situation very similar to that thus indicated has arisen in connection with power development at Niagara falls. The complaint is made there by Canadian interests that power which is properly applicable to Canadian industries is being exported to the United States in pursuance of arrangements made in former years, and difficulty arises in securing a cessation of this export of power.

In this connection, we submit that it is in the highest degree unwise for the Governments of Canada and the United States to encourage the exportation of power from one country to another when circumstances are such that, in the near future, each country will require all the power which it can legitimately develop or to which it is legitimately entitled. The subjects of the two countries will inevitably call for the intervention of their Governments, and the result will be that international disputes will arise.

It is submitted that the power situation in the provinces of Ontario and Quebec should be fully considered before any action is taken looking to the granting of private rights of the character sought by the present application. Such consideration will show that the power situation has developed very rapidly within the last few years and, so far from there being an excess of power capable of being developed at easily accessible points, it is certain that within the next twenty years all the power that can be developed at points where the same can be conveniently used will be required for use in Canada.

The power situation is intimately related to the fuel situation. The question of fuel in the province of Ontario is becoming an increasingly serious one, and the time will come very soon when electric power will be largely used for the purpose of operating the railways in the province of Ontario and for other purposes for which coal is at present employed. If a little consideration is given to the subject upon these lines, it will readily be seen that it is improvident in the highest degree for vested interests to be created which may conceivably prevent the people of Canada from enjoying full and beneficial use of the water-powers which are the property of the public.

Many other considerations arise to which no reference has been made herein, but, if an opportunity is permitted, no doubt the various interests affected will place their objections before you. In the meantime, we suggest that no action be taken without giving the fullest opportunity for discussion.

Yours faithfully

(Signed) CLIFFORD SIFTON  
*Chairman*

The Honourable, the Minister of Public Works,  
Ottawa.



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